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**DRAFT FINAL DECISION DOCUMENT
OTHER CONTAMINATION SOURCES
INTERIM RESPONSE ACTION
SOUTH TANK FARM PLUME**

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**Prepared by
MK-Environmental Services
Denver, Colorado**

**Prepared for
Shell Oil Company/Holme Roberts & Owen
Denver, Colorado**

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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 01/00/01		3. REPORT TYPE AND DATES COVERED	
4. TITLE AND SUBTITLE DRAFT FINAL DECISION DOCUMENT, OTHER CONTAMINATION SOURCES, INTERIM RESPONSE ACTION, SOUTH TANK FARM PLUME				5. FUNDING NUMBERS	
6. AUTHOR(S)					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) MORRISON-KNUDSEN ENGINEERS				8. PERFORMING ORGANIZATION REPORT NUMBER 91022R01	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) HOLME, ROBERTS AND OWEN				10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) THE SOUTH TANK FARM PLUME (STFP) IS LOCATED IN THE SOUTHERN HALF OF SECTIONS 1 AND 2. IT IS A COMPOSITE PLUME OF C6H6, MEC6H5, XYLEN, DCPD, AND BCHPD WHICH IS MIGRATING FROM THE AREA OF TANK 464A. RECENT INVESTIGATIONS HAVE SHOWN THAT THE STFP IS BEING BIODEGRADED NATURALLY AND WILL NOT MIGRATE INTO EITHER LAKE LADORA OR LOWER DERBY LAKE PRIOR TO IMPLEMENTATION OF THE FINAL REMEDY. MONITORING WITH THE SPECIFIC OBJECTIVES OF 1) VERIFYING THE RATE OF MIGRATION AND 2) LOCATING THE LEADING EDGE OF THE PLUME OVER THE TIME FRAME OF THE IRA IS PROPOSED AS THE PREFERRED ALTERNATIVE ACTION. SECTIONS OF THIS PROPOSED DECISION DOCUMENT PROVIDE SUMMARIES OF: 1. SITE DESCRIPTION - HISTORY, HYDROGEOLOGY, EXTENT OF CONTAMINATION 2. IRA OBJECTIVE 3. THE IRA PROJECT 4. CHRONOLOGY OF EVENTS LEADING TO THE INITIATION OF THE IRA 5. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, STANDARDS,					
14. SUBJECT TERMS IRA L				15. NUMBER OF PAGES DTIC QUALITY INSPECTED 2	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED				16. PRICE CODE	
18. SECURITY CLASSIFICATION OF THIS PAGE		19. SECURITY CLASSIFICATION OF ABSTRACT		20. LIMITATION OF ABSTRACT	

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1.0 INTRODUCTION/EXECUTIVE SUMMARY

The South Tank Farm Plume (STFP) is listed under the "Remediation of Other Contamination Sources" Interim Response Action (IRA) sites under the Final Technical Program Plan FY88-FY92 and the Federal Facility Agreement. The process and guidelines used to assess alternatives, produce this Draft Final Decision Document, and implement this IRA are specified in and conducted in accordance with the Federal Facility Agreement.

As listed in Section 22.8 of the Federal Facility Agreement, the purposes of the Proposed Decision Document for Other Contamination Sources IRAs are to: (a) state the objective of the IRA; (b) discuss Interim Response Action alternatives, if any, that were considered; (c) provide the rationale for the alternative selected; (d) present the final ARAR decision; (e) summarize the significant comments received regarding the IRA and responses to those comments; and (f) establish an IRA Deadline for completion of the IRA, if appropriate. Each of the above mentioned issues is addressed in this document.

The South Tank Farm Plume (STFP) is located in the southern half of Sections 1 and 2 on the Rocky Mountain Arsenal (RMA) (Figure 1-1). The constituents of the STFP are those present in the light nonaqueous phase liquid (LNAPL) plume, which is a source of the dissolved plume.

In 1989, Shell proposed, and the Army and EPA agreed, that the STFP be added to the list of RMA IRAs. The basis for the nomination and acceptance of this plume for an IRA was an apparent increase in concentration and areal distribution of the STFP compounds, notably benzene which defines the leading edge of the plume (Shell 1989). The data suggested that benzene was

Legend

- ++++ Railroad
- Stream/Drainage
- Study Area
- Plume
- Lakes



ROCKY MOUNTAIN ARSENAL South Tank Farm Study Area

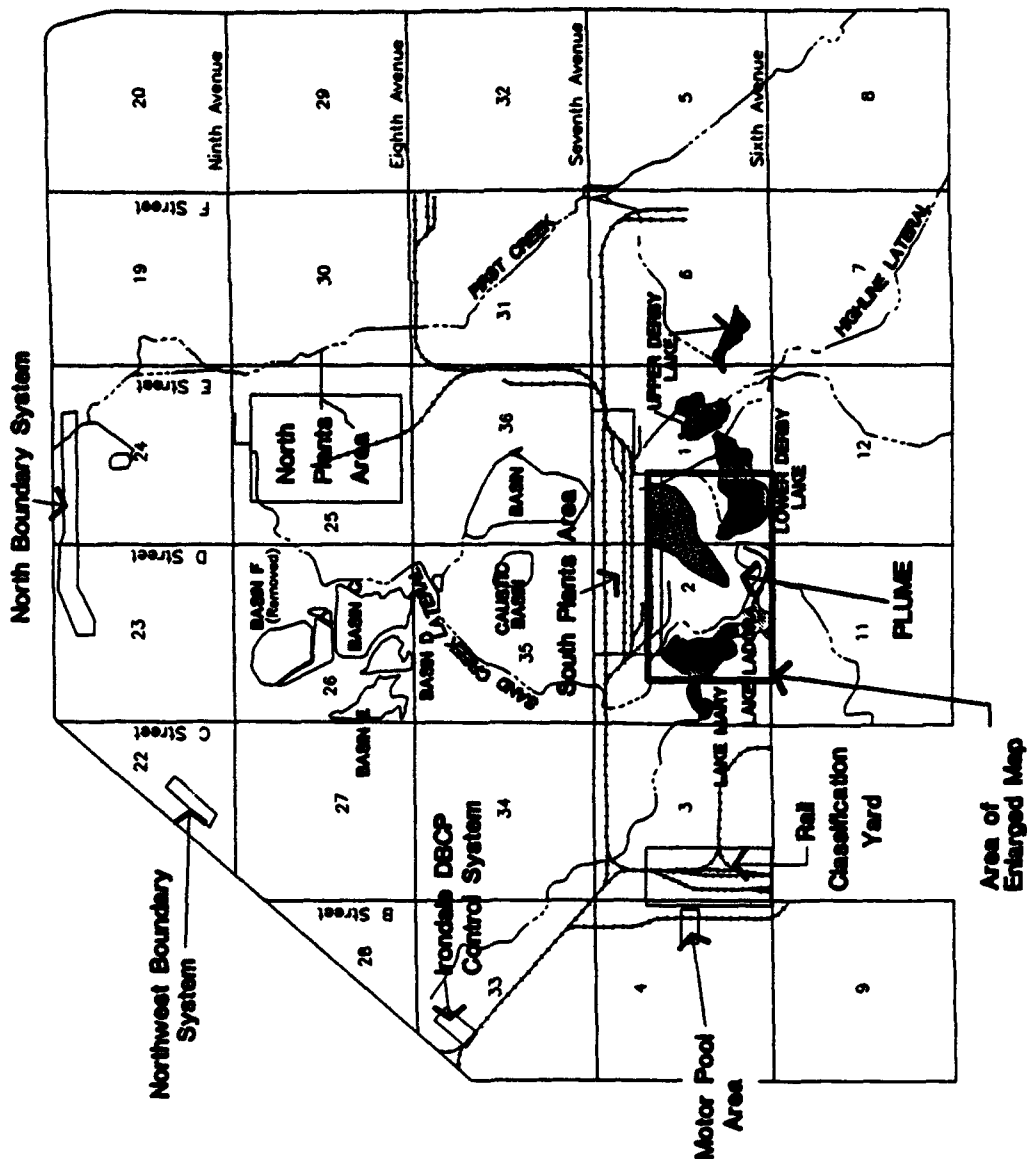
Figure 1-1

South Tank Farm Plume

Location Map



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migrating toward Lake Ladora rapidly enough to reach the lake prior to the implementation of the final remedy.

Based on this interpretation of the rate of contaminant migration, the original objective of the IRA was to prevent the STFP from reaching Lake Ladora prior to the implementation of the final remedy. However, recent investigations have shown that the STFP will not migrate into either Lake Ladora or Lower Derby Lake prior to the implementation of the final remedy and is biodegraded naturally (Shell May 1990, August 1990b, December 1990b).

Since there is no imminent threat of contamination to Lake Ladora or Upper Derby Lake by the STFP, interim response alternatives cannot be meaningfully developed or evaluated within the context of the original objective of this IRA. In accordance with Section 22.1(1) of the Federal Facility Agreement which addresses the "assessment and, as necessary, the selection and implementation of an IRA . . .", an evaluation of monitoring as the appropriate course for the interim response action has been conducted. This evaluation shows that: (1) the STFP poses no risk to human or non-human biotic receptors because it will not enter the lakes prior to the final remedy, and (2) there is no significant benefit in terms of cost or accelerated cleanup by conducting an IRA on the plume because of the low rate of contaminant migration and active biodegradation that are presently occurring in the plume. Therefore, monitoring with the specific objectives of verifying the rate of contaminant migration and ensuring current knowledge of the location of the leading edge of the plume over the time frame of the IRA, is the appropriate course for this IRA. Determination concerning the implementation of this IRA has been reached through a consideration of the objectives of Sections 2.3(a), 22.5, and 22.6 of the Federal Facility Agreement, and by application of the

Decision Flow Chart for Other Contamination Sources IRAs adopted by the Organizations and the State of Colorado at the June 7, 1989 Subcommittee meeting (Figure 1-2). The evaluation process is discussed further in Section 3.0.

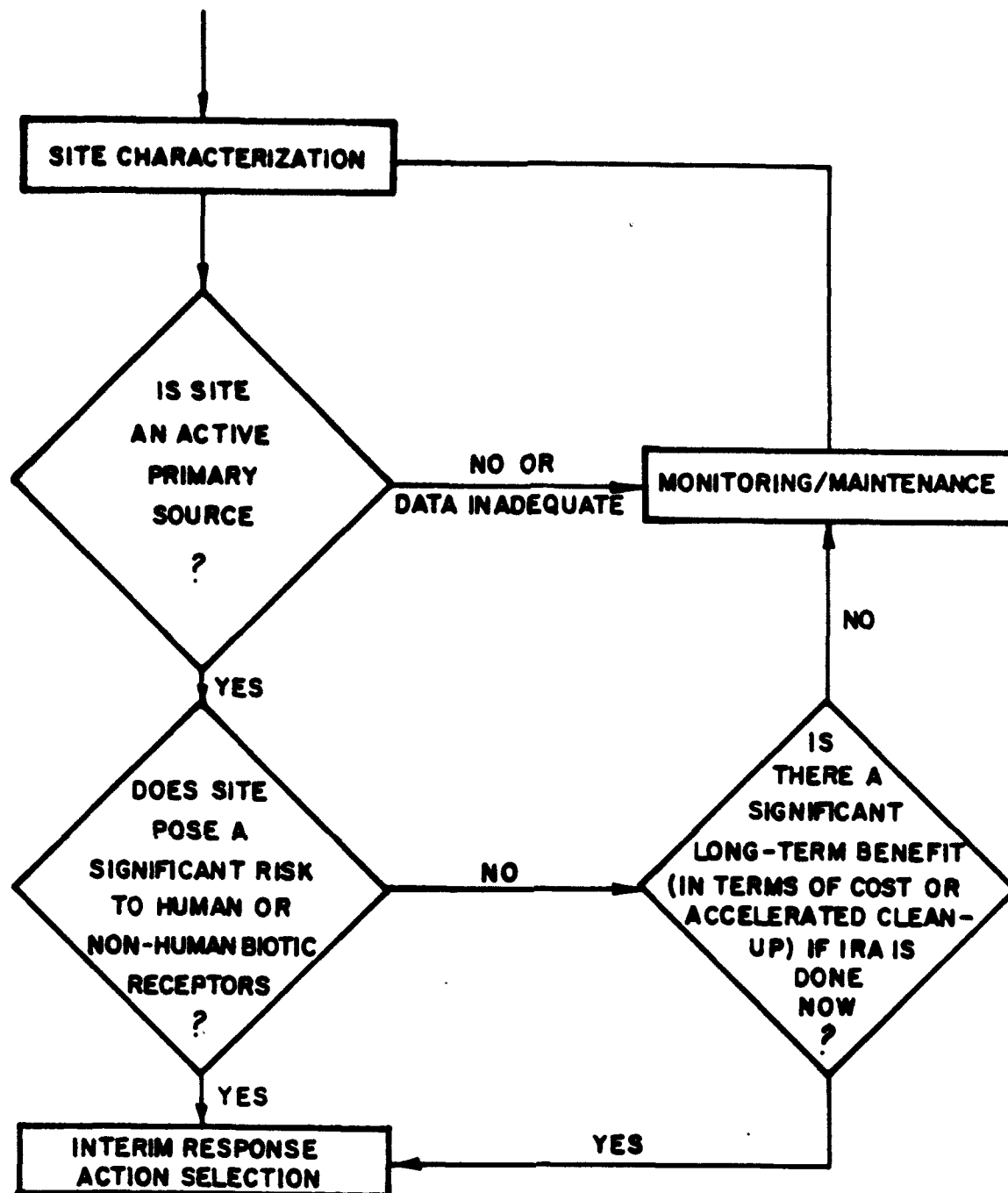


Figure : 1.2

**DECISION FLOW CHART FOR
INTERIM REMEDIAL ACTION
VERSUS MONITORING/MAINTENANCE**

Prepared by:



MK-ENVIRONMENTAL SERVICES
A DIVISION OF MK-FERGUSON

2.0 SITE DESCRIPTION

2.1 LOCATION AND SITE HISTORY

The STFP is defined as the composite plume of benzene, toluene, and xylene (collectively referred to as BTX), bicycloheptadiene (BCHPD), and dicyclopentadiene (DCPD) dissolved in the uppermost water-bearing zone (WBZ1) groundwater. Groundwater in WBZ1 flows radially away from the South Tank Farm to the southeast, south, and southwest. The dissolved plume originates from the area of a LNAPL plume located near Tank 464A.

The STFP and LNAPL plume constituents include compounds previously stored in the South Tank Farm (STF) and used in the manufacture of pesticides and compounds potentially associated with other production, disposal, and storage activities in the South Plants. Between 1947 and 1978, Tanks 464A, 464B, and others were used intermittently to store DCPD and BCHPD bottoms generated from pesticide manufacturing.

Tanks 464A and 464B were cleaned in 1956, 1966, and 1967. In 1956, BCHPD bottoms were "pumped" onto the ground, and the affected area was later cleaned up. In 1966, residue from a mixture of fuel oil and BCHPD bottoms containing DCPD was buried in the STF. In 1967, a mixture of DCPD bottoms and fuel oil was collected in a low spot in the STF, and later drummed and shipped offsite. From 1960-1963, leakage of BCHPD/DCPD bottoms occurred from a pipe connected to Tank 464A, although the quantity spilled is unknown. Additional disposal and spill events involving BCHPD and DCPD occurred at unidentified locations in the STF in 1964 and 1978, respectively.

Although records do not show that either benzene, toluene, or xylene were stored in the STF, a large spill of benzene

containing toluene and xylene impurities reportedly occurred at an unidentified location in the STF in 1948. Toluene may also have been present in trace amounts in BCPD.

2.2 HYDROGEOLOGY

Two geologic units occur in the STFP study area: an upper alluvial unit, underlain by the Denver Formation. The alluvium consists of brown, unconsolidated, silty sand with increasing silt and clay content at depth. The alluvium ranges from approximately 5 feet thick near the STF to 25 feet thick near Lake Ladora.

The Denver Formation underlying the alluvium is composed of brown to green, weathered and unweathered claystones, mudstones, and siltstones. These strata, referred to as the VC (volcaniclastic unit) and VCE (volcaniclastic equivalent unit) in the South Plants Study Area Report (Ebasco 1989), are fractured. The uppermost portion of the Denver Formation is weathered and averages 4 to 6 feet thick, but may extend to approximately 20 feet at some locations. Lithologic variability near the leading edge of the STFP is shown by the geologic cross-section in Figure 2-1.

The STFP affects the WBZ1, as defined in the South Plants Study Area Report (Ebasco 1989). WBZ1 encompasses saturated alluvium and the uppermost weathered Denver Formation. The top of WBZ1 is defined by the water table and the base is defined by a green to brown Denver Formation claystone exhibiting a lesser degree of fracturing and weathering (Ebasco 1989, Shell 1989). In the STFP area, WBZ1 ranges in saturated thickness from approximately 10 to 25 feet.



The water table occurs in the alluvium in the northwestern and southeastern portions of the study area, and in the weathered Denver Formation immediately southwest of the STF (Figure 2-2). Groundwater in WBZ1 flows away from the STF to the southeast, south, and southwest. The water table gradient is reduced near the lakes, although near the northwest corner of Lower Derby Lake groundwater flowpaths are deflected sharply towards the southwest and in the direction of Lake Ladora.

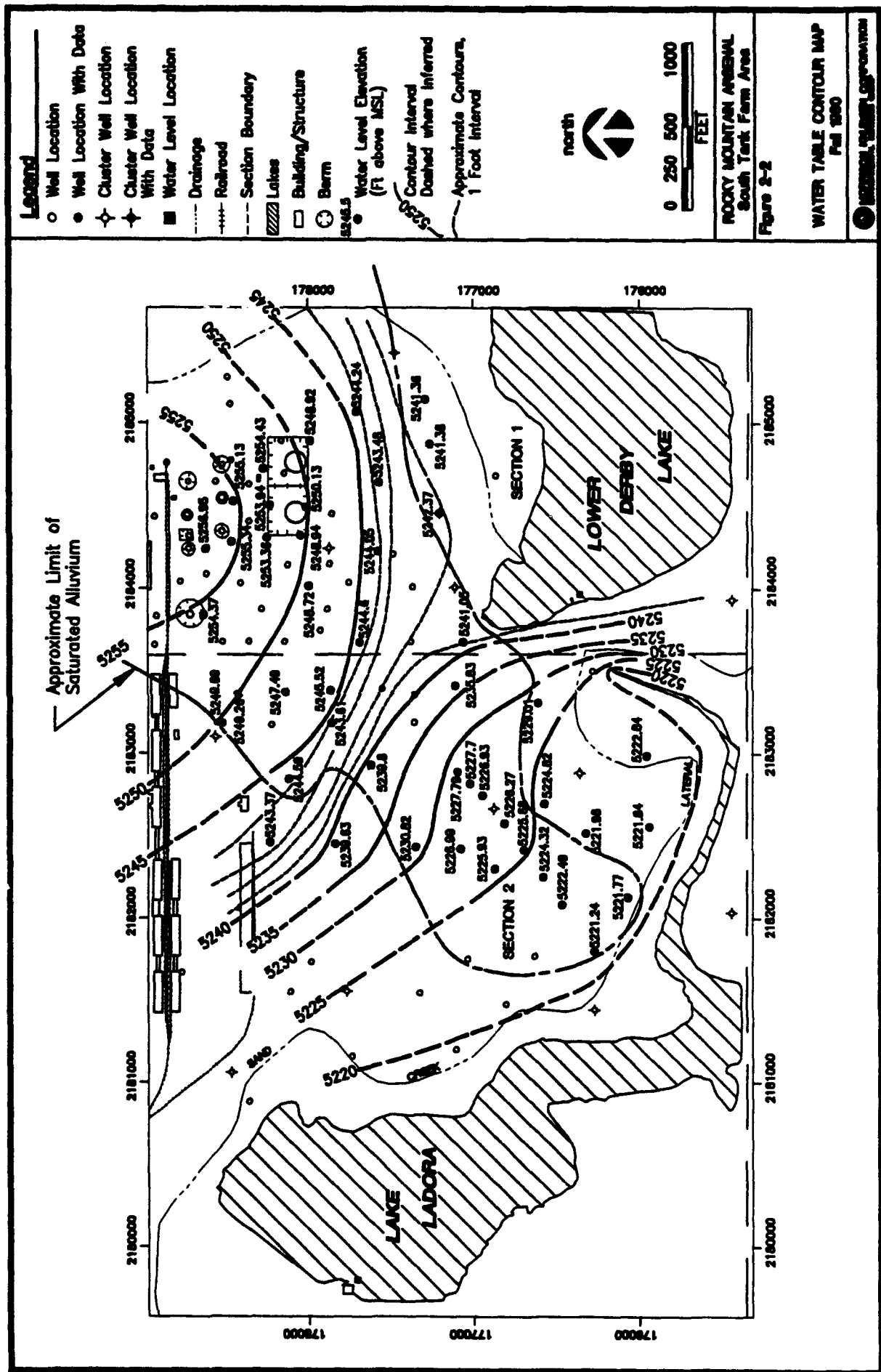
Water levels in the STF area have been declining (RMA-PMO database). Since the spring of 1988, water levels near the tank farm have declined as much as 5 feet, while water levels in wells near Lake Ladora have declined approximately 1 to 2 feet (Shell May 1990 and December 1990b).

The hydraulic gradient in the STF area varies from approximately 0.015 ft/ft in the vicinity of the tanks to less than 0.005 ft/ft near Lake Ladora (Figure 2-2). The water-level data in the RMA database indicate that the average hydraulic gradient for the STF area appears to be slightly decreasing with time.

In the Fall of 1989, single-well injection (slug) tests were conducted within the weathered Denver Formation near Lake Ladora and Lower Derby Lake. The calculated hydraulic conductivities from seven slug tests conducted near Lake Ladora ranged from 1.6×10^{-3} to 4.3×10^{-5} cm/sec, and from 4.0×10^{-4} to 3.4×10^{-4} cm/sec for the tests performed in the vicinity of Lower Derby Lake. These estimates appear to be in agreement with the observed field data.

2.3 NATURE AND EXTENT OF CONTAMINATION

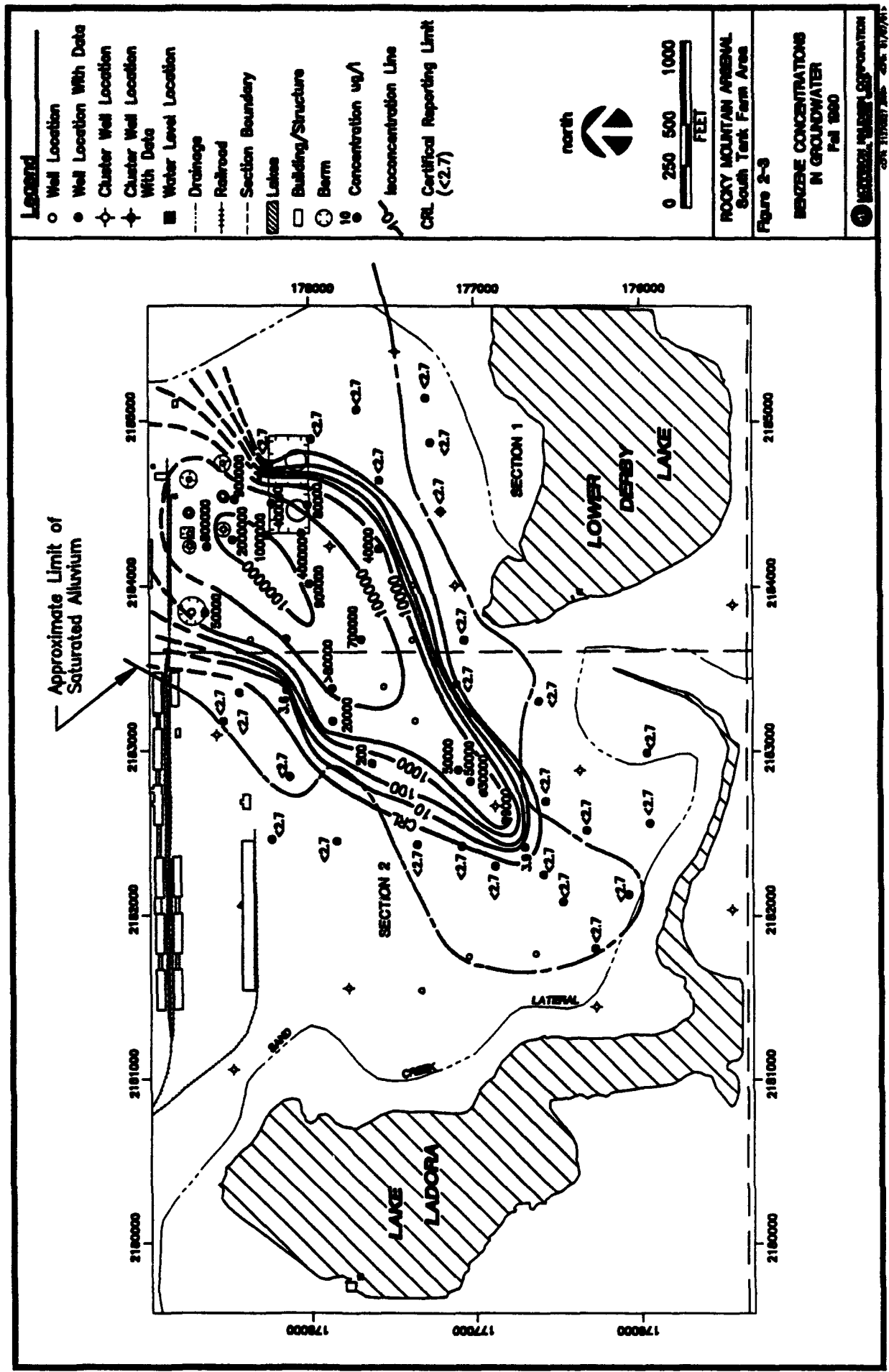
LNAPL near Tank 464A is the primary source for the STF dissolved phase plume and the highest concentrations in groundwater occur



primarily near Tank 464A (Figures 2-3 through 2-7). Benzene exhibits the greatest concentration and areal distribution of the STFP compounds, and defines the leading edge of the STFP directed southwest toward Lake Ladora. DCPD is the most widely distributed contaminant within the south-southeastern component of the STFP and defines the leading edge of the plume towards Lower Derby Lake. None of the STFP compounds were detected in wells located within 500 feet of either Lake Ladora or Lower Derby Lake.

Based on a comparison between the 1983/84 and Spring 1990 water quality data, the observed average rate of contaminant migration at the leading edge of the plume was approximately 33 ft/yr. The recent Fall 1990 investigations indicate the plume has not advanced since Spring 1990. Using a conservative basis, this historically observed average migration rate and the current location of the leading edge of the plume (approximately 1350 feet upgradient of Lake Ladora along the groundwater flowpath and 900 feet from the nearest point of Lake Ladora), the STFP is not expected to impact Lake Ladora prior to implementation of the final remedy.

Groundwater quality information obtained during 1990 show an inverse correlation between dissolved oxygen (DO) concentrations and the total concentrations of benzene, toluene and xylene. This becomes evident along the axis of the STFP; near the suspected source where BTX concentrations are high, the DO levels are low; and at the edge of the plume, where BTX concentrations are lower, DO levels are higher. This inverse correlation is consistent with data presented by Chiang et al. (1989), and indicates that these aromatic compounds are biodegraded in the presence of appropriate DO concentrations. The biodegradation occurring in the STFP contributes to the variability and recently



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Isocentration Line

Concentration ug/l

Berm

Building/Structure

Lakes

Section Boundary

Railroad

Drainage

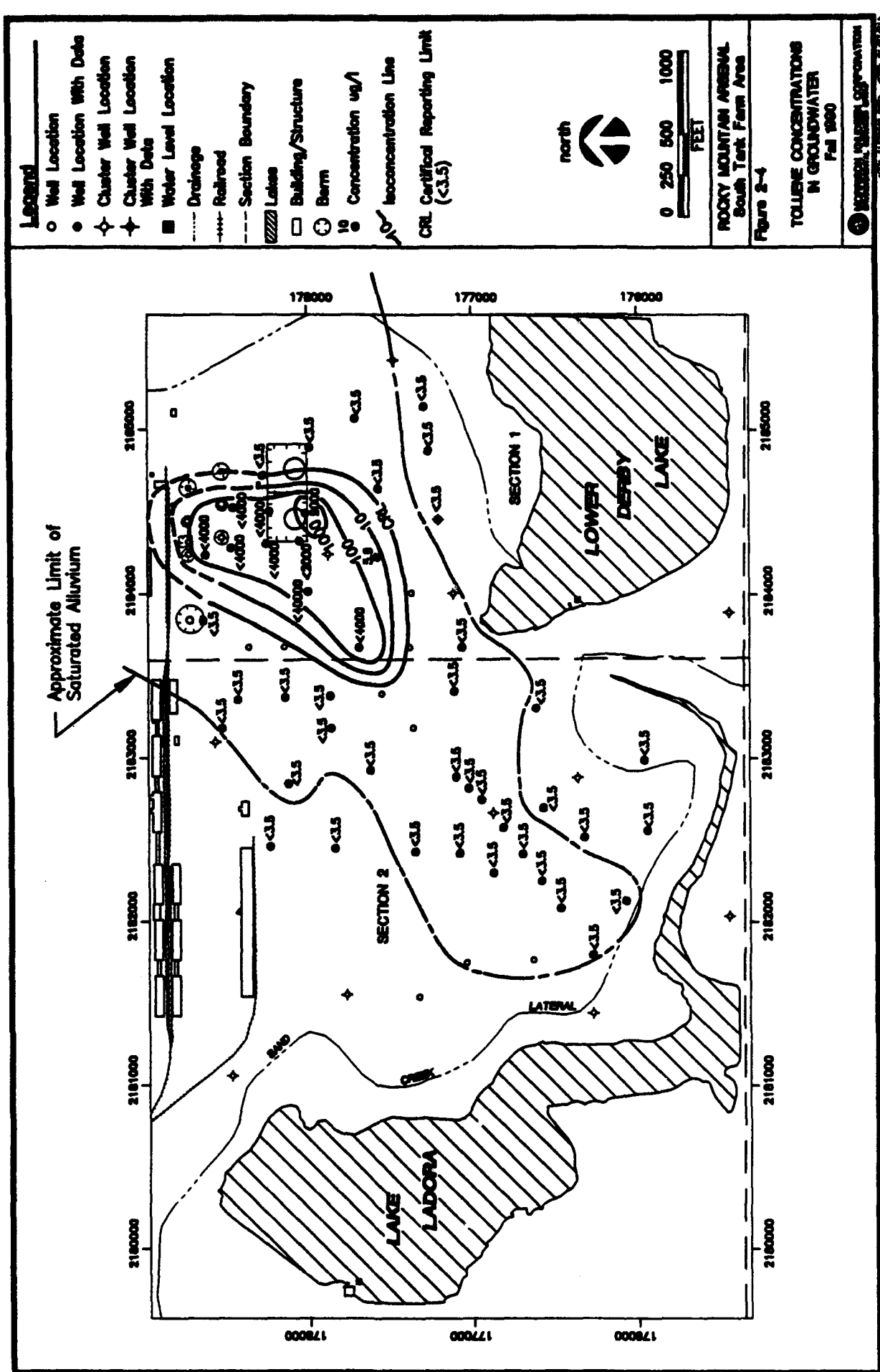
Water Level Location

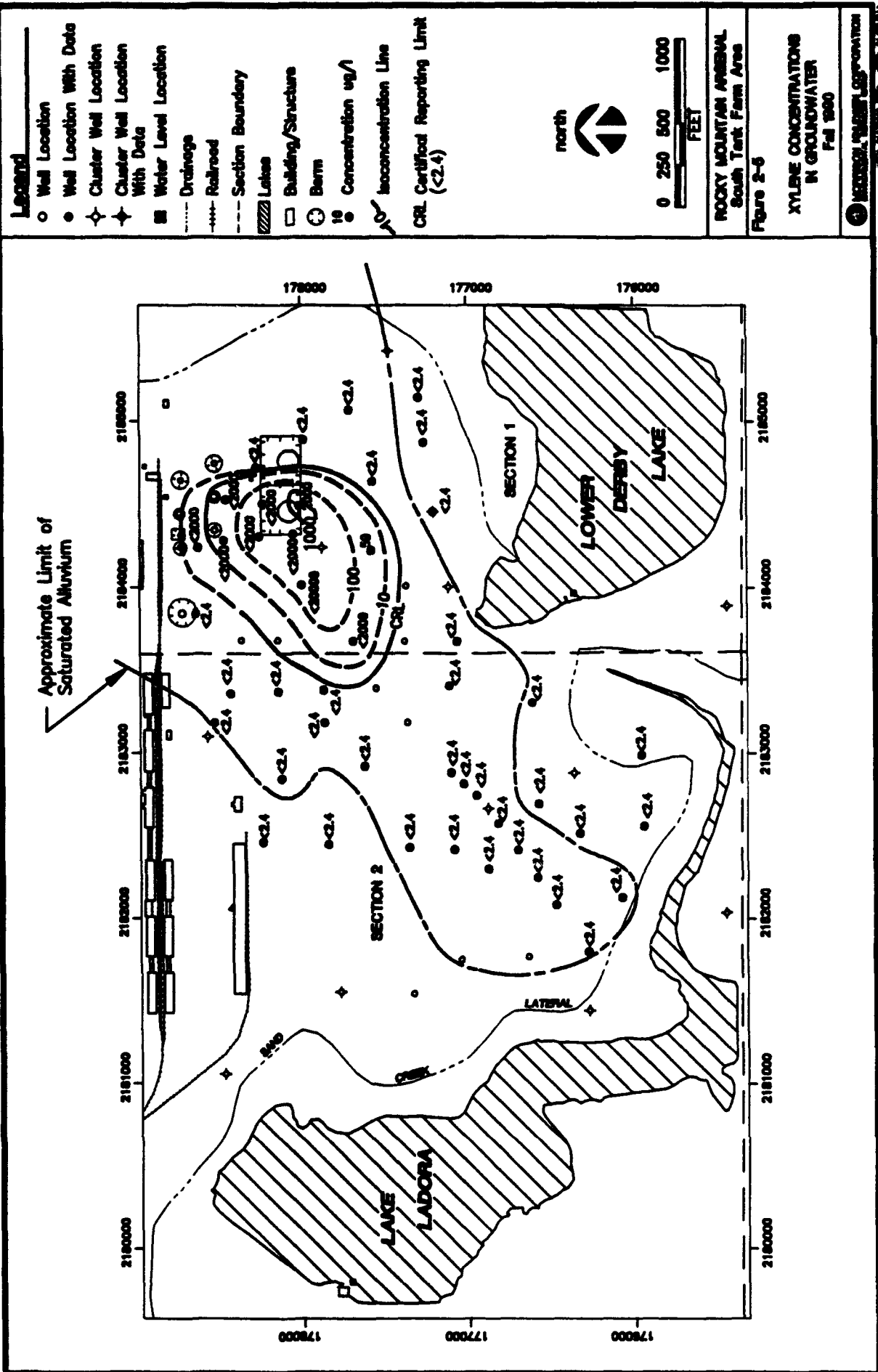
Cluster Well Location With Data

Cluster Well Location

Well Location With Data

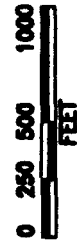
Well Location





Legend

- Well Location
- Well Location With Data
- ✦ Cluster Well Location
- ✦ Cluster Well Location With Data
- Water Level Location
- Drainage
- Railroad
- Section Boundary
- ▨ Lakes
- Building/Structure
- ⊕ Berm
- ⊙ Concentration ug/l
- ⊙ Isoconcentration Line
- CRL Certified Reporting Limit (<1.5)

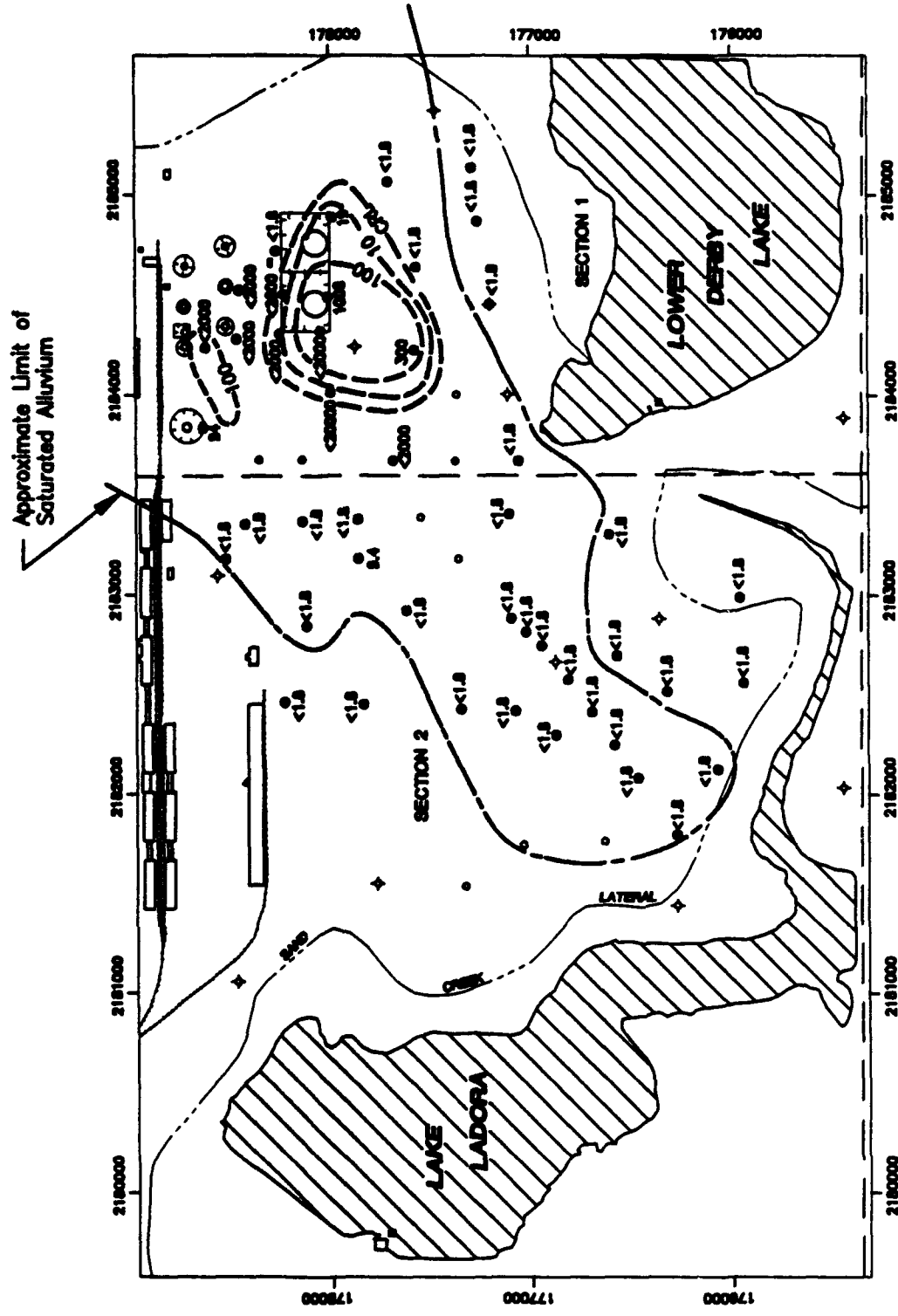


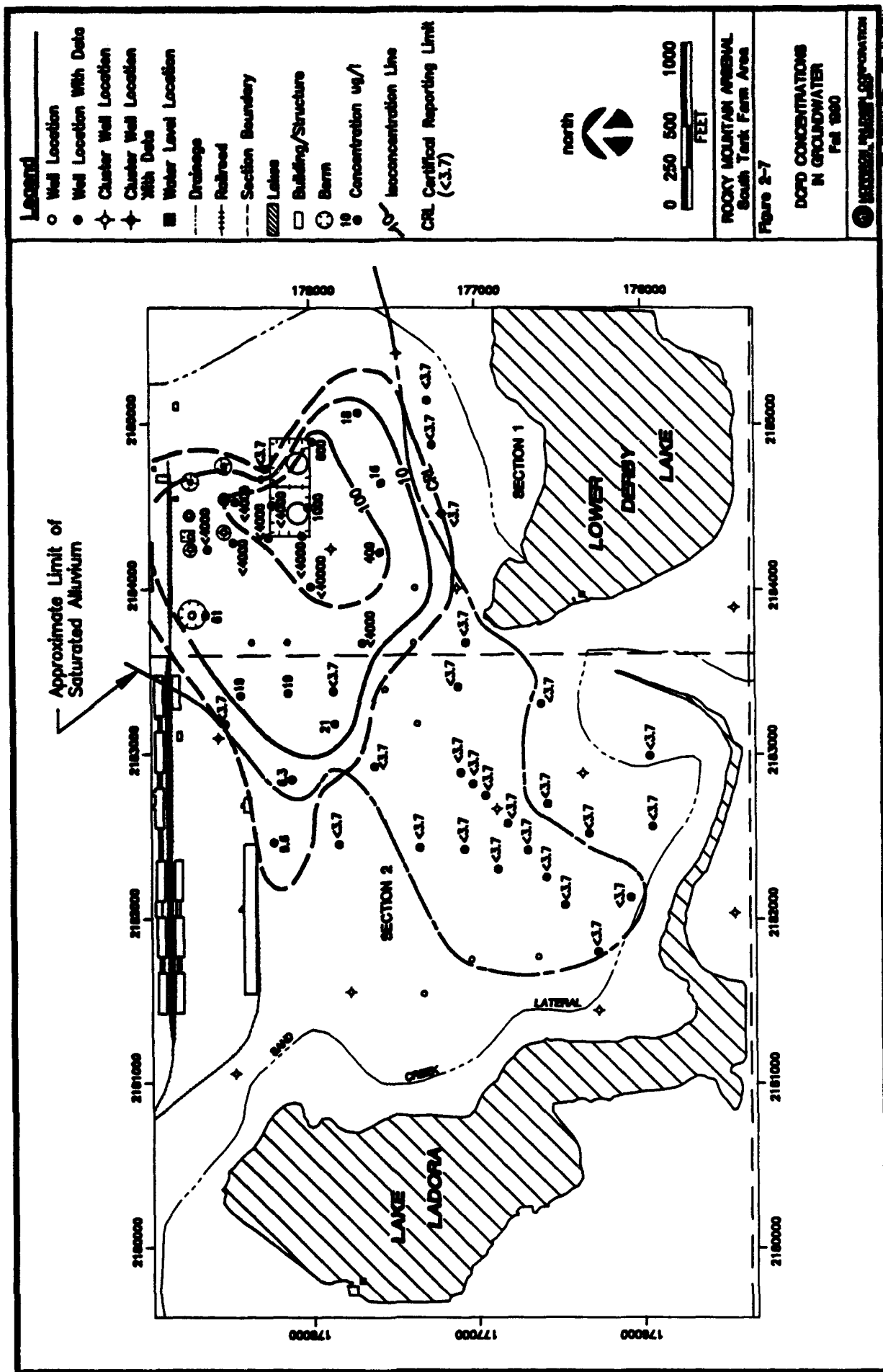
ROCKY MOUNTAIN ARSENAL
South Tank Farm Area

Figure 2-6

BO-FO CONCENTRATIONS
IN GROUNDWATER
Fall 1990

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ON 11/28/95 26-000000





observed decrease in benzene concentrations in wells near the plume margin (Shell May 1990 and December 1990b).

Additionally, laboratory studies conducted using saturated sediment samples from the RMA verify the existence of bacteria capable of degrading BTX and demonstrate the increased rate of biodegradation at higher concentrations of dissolved oxygen (Shell May 1990 and August 1990b).

In summary, the results of the 1990 investigation indicated that:

- (1) STFP compounds are not expected to migrate into either lake before the final remedy can be implemented. Therefore, there is no imminent threat of contamination to Lake Ladora or Lower Derby Lake due to STFP compounds;
- (2) no STFP compounds were detected in monitoring wells located within 500 feet of either lake;
- (3) cross-contamination probably occurred during the Spring 1988 sampling event resulting in the overestimation of the extent and rate of dissolved benzene migration; and
- (4) natural biodegradation causes significant temporal and spatial variability in the concentrations of benzene, particularly in wells located near the plume margin.

3.0 INTERIM RESPONSE ACTION OBJECTIVE AND EVALUATION

The original objective of the STFP IRA was to prevent the STFP from migrating into Lake Ladora. This objective was based on the interpretation that the STFP may migrate into Lake Ladora prior to the implementation of the final remedy (Shell 1989). However, recent investigations have shown that the STFP will not migrate into either Lake Ladora or Lower Derby Lake prior to the implementation of the final remedy and is actively being biodegraded (Shell May 1990, August 1990b, and December 1990b).

Therefore, interim response alternatives cannot be meaningfully developed or evaluated within the context of the original objective of this IRA. In accordance with Section 22.1(1) of the Federal Facility Agreement which addresses the "assessment and, as necessary, the selection and implementation of an IRA . . .," an evaluation of monitoring as the appropriate course for the STFP IRA has been conducted as specified in the Final Task Plan for Remediation of Other Sources Interim Response Action (Woodward-Clyde 1989). The results of this evaluation follow.

Figure 1-2 shows the questions which must be answered to determine whether monitoring is the appropriate course for "hotspot" IRAs (Woodward-Clyde 1989). The answers to these questions for the STFP are as follows:

1. The LNAPL portion of the STFP is an active, primary source of contaminants; however,
2. Neither the LNAPL nor the leading edge of the dissolved plume pose significant risk to human or non-human biotic receptors since neither plume is migrating into the

lakes, nor expected to do so, prior to the final remedy;
moreover,

3. There is no significant long-term benefit (either cost or accelerated cleanup) of conducting an interim response action on the dissolved or LNAPL plumes since migration is very slow. In addition, natural biodegradation of the dissolved plume is occurring.

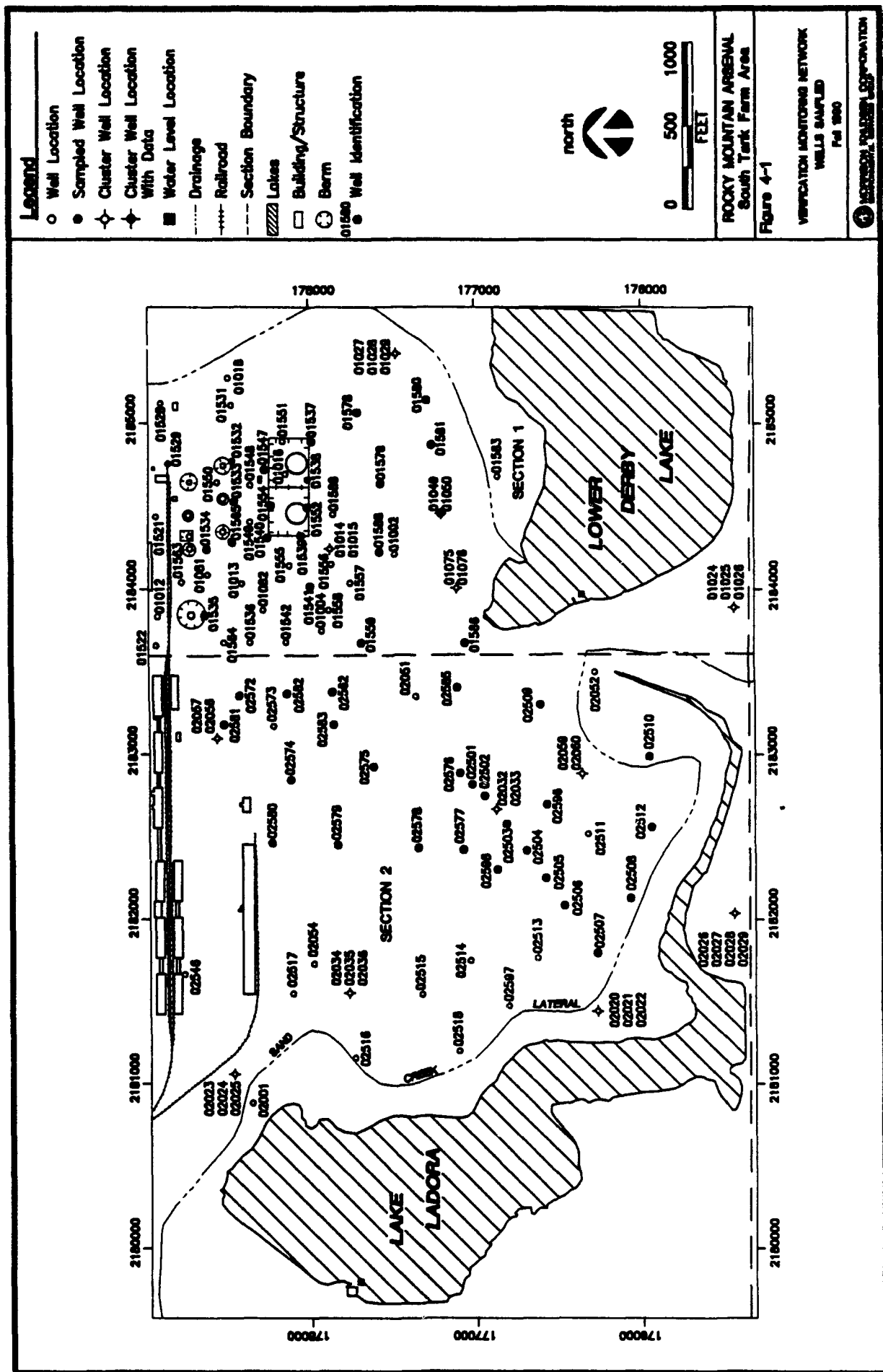
Therefore, according to the decision logic agreed upon by the Organizations and State, monitoring is the appropriate action for this IRA. Accordingly, the objective of this IRA is to monitor the STFP to: (1) verify the data upon which conclusions on the rate of contaminant migration have been made (Shell May 1990 and December 1990b), and (2) verify the location of the leading edge of the dissolved plume over time. The monitoring network proposed to achieve these objectives is described in Section 4.

4.0 DESCRIPTION OF THE INTERIM RESPONSE ACTION

The monitoring network proposed to meet the objectives of the STFP IRA consists of three components:

- One-time comprehensive verification monitoring program of groundwater quality throughout the STFP to verify conclusions regarding the rate of contaminant migration and occurrence of biodegradation presented in Shell May 1990. The verification monitoring program was completed December 1990 and the results are presented in Shell December 1990b.
- Routine annual monitoring of selected wells to verify the location of the leading edge of the STFP with respect to the South Lakes; and
- Semi-annual monitoring of the water table throughout the STFP area to identify changes to groundwater flow directions and gradients that may alter established contaminant migration patterns and/or rates.

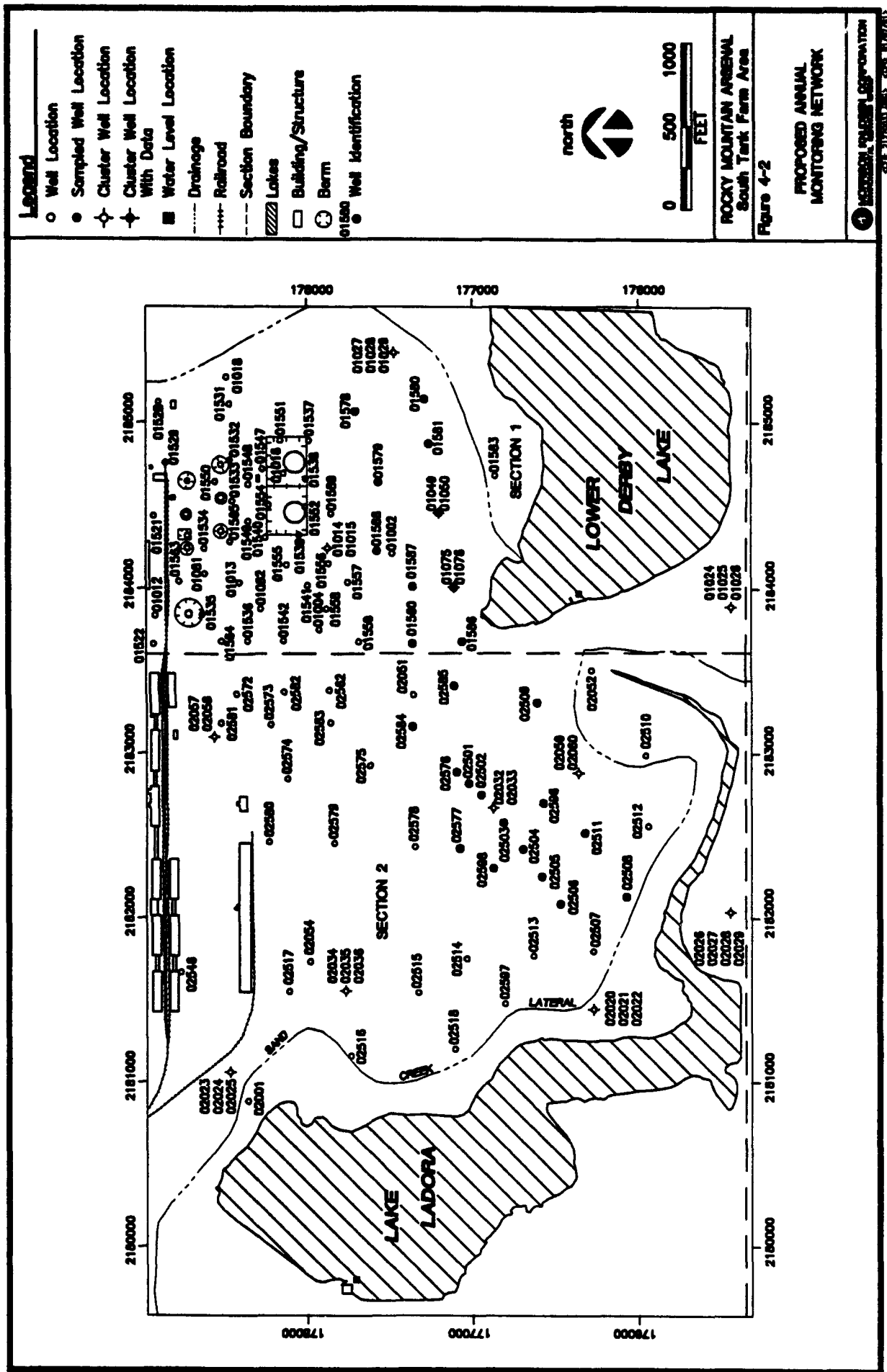
The verification program monitoring network consists of 46 wells located throughout the STFP area (Figure 4-1). This program was completed Fall 1990 (Shell December 1990b) in support of this IRA document. Target analytes included benzene, toluene, xylene, BCHPD, and DCPD. Target analyte concentrations were determined using USATHAMA Method UU-8 (volatile compounds). To prevent the loss of volatile compounds during sample collection, a submersible pump was used whenever possible. Wells were sampled sequentially from areas of low concentration to areas of higher concentration based on analytical data from Spring 1990 sampling. Field measurements of DO were made at the time of sample collection. Information from this monitoring program was used to verify the extent and migration rate of STFP constituents and to

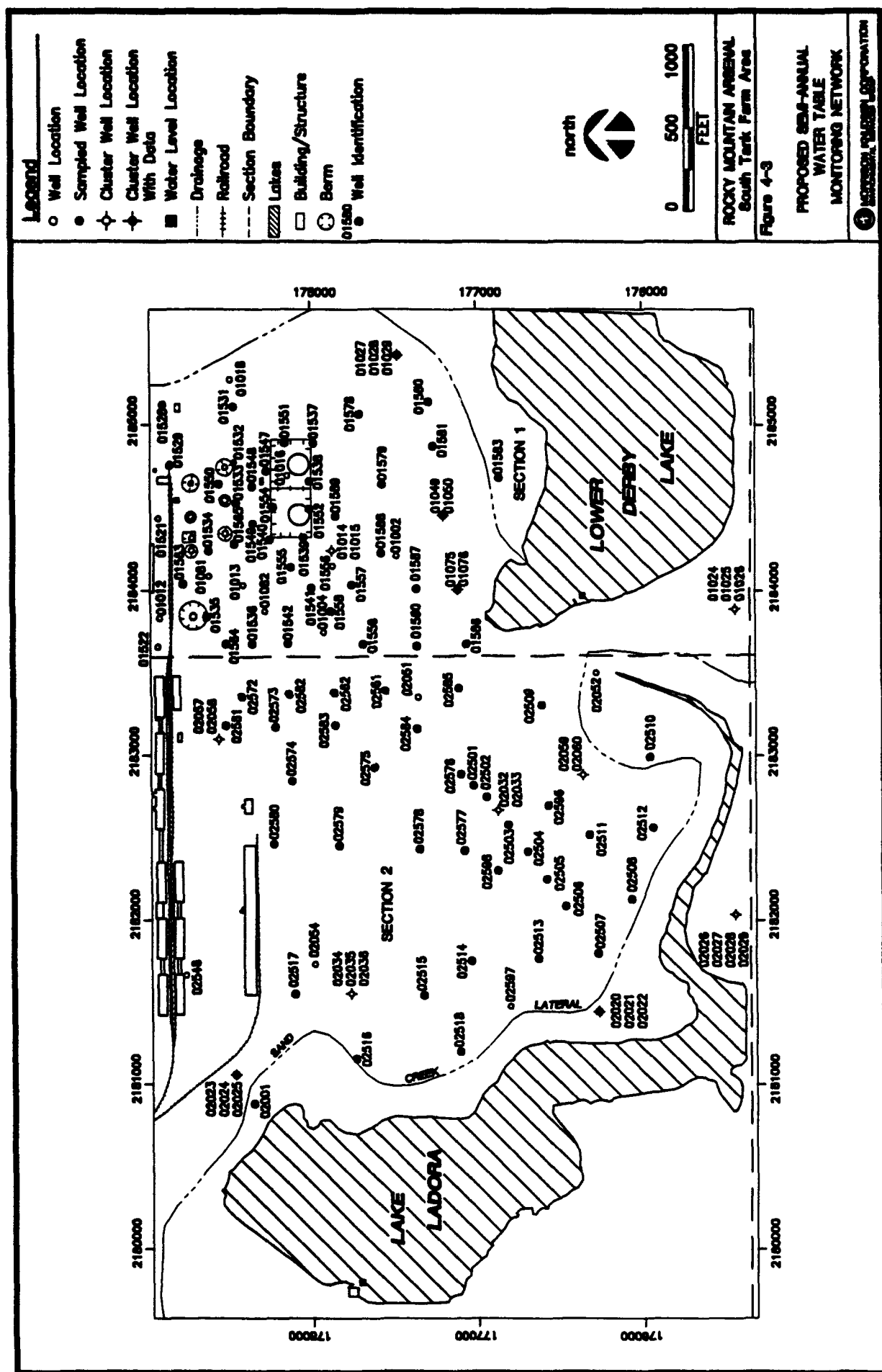


verify the existence of conditions conducive for biodegradation within the SFP.

Routine monitoring will be performed to verify the location of the leading edge of the SFP (Figure 4-2). Groundwater quality will be monitored annually in 24 wells to meet this objective. The design of this monitoring program will be identical to that of the verification monitoring program with respect to target analytes, field measurements of dissolved oxygen, sampling and decontamination procedures, and analytical methods. Monitoring of the leading edge of the SFP will be performed annually until the ROD is issued.

In addition to groundwater quality monitoring, the water table in Sections 1 and 2 will be monitored semi-annually, as a minimum, to identify changes in groundwater flow directions and gradients within the WBZ1 that may alter established contaminant migration patterns and/or rates (Figure 4-3).





5.0 CHRONOLOGY OF EVENTS

The significant events that led to the decision to implement a monitoring program for the STFP IRA are as follows:

<u>Date</u>	<u>Event</u>
June 1987	The State of Colorado, Shell Oil Company, U.S. EPA, and U.S. Army agreed to 13 Interim Response Actions, including Remediation of Other Contamination Sources (also known as the "Hotspot Sources").
February 1988	Proposed Consent Decree lodged in the case of <u>U.S. v. Shell Oil Company</u> with the U.S. District Court in Denver, Colorado. The Consent Decree specified 13 Interim Response Actions, including the Hotspot Sources.
February 1989	The <u>Federal Facility Agreement</u> incorporated the 13 Interim Response Actions specified in the Proposed Consent Decree including the Hotspot Sources.
July 1989	Shell Oil Company completes the <u>Results of Hydrogeologic and Water Quality Investigations in the South Tank Farm Plume, Section 2, RMA</u> report. In the cover letter to the report, Shell proposes the STFP benzene plume be included as a "Hotspot" IRA.
August 1989	Shell Oil Company submitted <u>Report of the Investigation of the LNAPL Plume Near Tank 464A, Section 1, RMA</u> to the U.S. Army. The U.S. Army and U.S. EPA agree to include the South Tank Farm Plume as a "Hotspot" IRA.

May 1990

Shell Oil Company submitted Hydrogeologic and Water Quality Conditions, South Tank Farm Plume, RMA to the U.S. Army. The Army issued this report to the Organizations and State for review and comment.

June 1990

Shell Oil Company submitted Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume to the U.S. Army. The Army issued this report to the Organizations and State for review and comment.

July 1990

Shell Oil Company received comments from the U.S. EPA, U.S. Department of Interior (DOI), and the State on the Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume and Hydrogeologic and Water Quality Conditions, South Tank Farm Plume, RMA on July 24, 1990.

August 1990

Shell Oil Company submitted Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume and Proposed Decision Document, Other Contamination Sources, Interim Response Action, South Tank Farm Plume to the U.S. Army. The Army issued this report to the Organizations and State for review and comment.

September 1990

Shell Oil Company received comments from the U.S. EPA and the State on the Proposed Decision Document, Other Contamination Sources, Interim Response Action, South Tank Farm Plume on September 24, 1990.

October 1990

An RMA Committee Meeting was held October 12, 1990. The parties agreed to postpone issuing the Draft Final Decision Document, Other Contamination Sources, Interim Response Action, South Tank Farm Plume until mid-January 1991. In the interim Shell and the Army were to provide support documents.

December 1990

Shell Oil Company submitted Results of the Verification Monitoring Program, South Tank Farm Plume, RMA, Technical Work Plan, LNAPL Plume Soil Vapor Extraction Process Field Demonstration Treatability Study, Laboratory Screening Studies on the Biodegradation of Organics in RMA Groundwater, and Project Status Report, Laboratory Studies on Biodegradation of Organics in South Tank Farm Plume Aquifer Samples, to the U.S. Army. The Army issued these reports and the Army report Potential Migration of Contaminated Groundwater to Lakes Ladora and Lower Derby to the Organizations and State for review and comment.

01/07/91

6.0 IRA PROCESS

The IRA process for the STFP IRA is as follows:

- 1. As Lead Party, Shell prepared a "Draft Final Alternatives Assessment for Other Contamination Sources, Interim Response Action, South Tank Farm Plume, RMA." The report was submitted to the U.S. Army for issuance to the DOI and the other Organizations and the State for review and comment. Comments were submitted by the DOI, U.S. EPA, and the State.**
- 2. Shell, DOI, and the other Organizations and State will be afforded the opportunity to participate, at the RMA Committee level, in the identification and selection of ARARs pertinent to this IRA.**
- 3. As Lead Party, Shell submits this Proposed Decision Document for the South Tank Farm Plume IRA to the U.S. Army for issuance to the DOI and other Organizations and State. It includes the Army's final ARARs decision. Upon issuance, the Proposed Decision Document is subject to a 30-day public comment period during which the other Organizations and State, the DOI, or any other person may comment on it. Time permitting, the Army shall hold at least one public meeting during the comment period to inform the community in the vicinity of the RMA about this IRA.**
- 4. Promptly after the close of the comment period, Shell will submit the Draft Final Decision Document for the South Tank Farm Plume IRA to the U.S. Army for transmittal to the DOI and other Organizations and State.**

5. Within 20 days after issuance of the Draft Final Decision Document for the South Tank Farm Plume IRA, an Organization (including the State if it has agreed to be bound by the Dispute Resolution process, as required by the Federal Facility Agreement, or DOI under circumstances set forth in the Federal Facility Agreement) may invoke Dispute Resolution. Dispute Resolution may concern either the proposed IRA or the Army's ARAR decision.
6. After the close of the period invoking Dispute Resolution (if Dispute Resolution is not invoked) or after the completion of Dispute Resolution (if invoked), Shell shall submit a Final Decision Document for the South Tank Farm Plume IRA to the Army. The Final Decision Document will include comments received on the Proposed Decision Document and responses to those comments. The Army shall then issue a Final Decision Document to the other Organizations, the State, and DOI. If Dispute Resolution has been invoked, the decision may be subject to judicial review in accordance with Section 39.2 of the Federal Facility Agreement.
7. Following issuance of the Final IRA Decision Document, Shell shall be the Lead Party responsible for designing and implementing the IRA in conformance with the Decision Document. Shell shall issue a Draft Implementation Document to the DOI and the other Organizations for review and comment. This Draft Implementation Document shall include final drawings and specifications, final design analyses, a cost estimate, and a schedule for implementation of the IRA.

8. As Lead Party for design and implementation of this IRA, Shell will issue the Final Implementation Document, as described above, and will be responsible for implementing the IRA in accordance with the IRA Implementation Document.

**7.0 APPLICABLE OR RELEVANT AND APPROPRIATE
REQUIREMENTS FOR THE REMEDIATION OF
OTHER CONTAMINATION SOURCES (SOUTH TANK FARM PLUME)
INTERIM RESPONSE ACTION**

7.1 INTRODUCTION

These Applicable or Relevant and Appropriate Requirements (ARARs) address a specific area identified for evaluation for remediation prior to the issuance of a Record of Decision (ROD) for the Onpost Operable Unit of the Rocky Mountain Arsenal. The actions selected involve monitoring the plume which emanates from the area of the South Tank Farm. Some standards are discussed in general terms, to be further defined as more specific remedial actions are identified.

7.2 AMBIENT AND CHEMICAL-SPECIFIC ARARs

Ambient or chemical-specific requirements set concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. Such ARARs either set protective cleanup levels for the chemicals of concern in the designated media or indicate an appropriate level of discharge based on health and risk-based analyses and technological considerations.

The objectives of this IRA are discussed in the Assessment Documents. This IRA will be implemented prior to the final remediation to be undertaken in the context of the Onpost Operable Unit ROD. The lists of specific contaminants included in the Assessment Documents have been completed based upon the field data concerning these specific sources. Since the selected approaches for this IRA do not involve the treatment of groundwater from the area of the South Tank Farm Plume, no

chemical-specific ARARs concerning water were selected for this IRA.

Air Emissions

The approaches selected by this IRA do not involve the operation of any treatment system which will result in air emissions. The monitoring to take place in the area of the South Tank Farm Plume will not affect any emissions that may originate in that area, but air monitoring will identify any potential concerns regarding emissions from this area.

The standards contained at 40 CFR Part 50 were reviewed and determined to be neither applicable nor relevant and appropriate to this IRA. These standards apply to Air Quality Control Regions (AQCR), which are markedly dissimilar from the area within which activity is being conducted pursuant to this IRA. An AQCR is generally a very large area, covering many square miles. The South Tank Farm Plume covers an extremely small area, far smaller than an AQCR. These standards are not generally applied to specific emissions sources, such as automobile tailpipes and smokestacks. These considerations lead to the determination that these ambient air standards are neither relevant nor appropriate to apply within the context of this IRA.

Other air standards, such as those contained at 40 CFR Parts 60 and 61 and similar state standards such as those contained at 5 CCR 1001-10, Regulation 8 were not considered as potential ARARs since the IRA will not include a treatment system which causes air emissions.

7.3 LOCATION-SPECIFIC ARARs

Location-specific requirements set restrictions on activities, depending on the characteristics of the site or the immediate environment, and function like action-specific requirements. Alternative remedial actions may be restricted or precluded, depending on the location or characteristic of the site and the requirements that apply to it.

Paragraph 44.2 of the Federal Facility Agreement provides that "wildlife habitat(s) shall be preserved and managed as necessary to protect endangered species of wildlife to the extent required by the Endangered Species Act (16 U.S.C. 1531 et seq.), migratory birds to the extent required by the Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), and bald eagles to the extent required by the Bald Eagle Protection Act, 16 U.S.C. 688 et seq."

While this provision is not an ARAR, the statutory requirements are ARARs and will be complied with for purposes of this IRA. Based on where facilities related to this IRA are likely to be located the Army believes that this IRA will have no adverse impact on any endangered species or migratory birds or on the protection of wildlife habitats. Coordination will be maintained with the U.S. Fish and Wildlife Service to ensure that no such adverse impact arises from implementation of this IRA.

The provisions of 40 CFR 6.302(a) and (b) regarding construction that would have an adverse impact on wetlands or be within a floodplain are considered relevant and appropriate to apply in the context of this IRA. The Army will comply with these regulations to the maximum extent practicable to avoid construction conducted pursuant to this IRA in a manner that would have an adverse impact on wetlands or be within a flood plain.

The regulations at 40 CFR 230 were reviewed and determined not to be applicable within the context of this IRA because no discharge of dredged or fill material into waters of the United States is contemplated. Because these regulations address only the disposal of such materials into the waters of the United States, which is not contemplated, they are not considered to be relevant and appropriate to apply in the context of this IRA.

The regulations at 33 CFR 320-330 were reviewed and determined to be neither applicable nor relevant and appropriate because they address actions affecting the waters of the United States. No such actions are contemplated within the context of this IRA.

7.4 ACTION-SPECIFIC ARARS

Description

Performance, design, or other action-specific requirements set controls or restrictions on activities related to the management of hazardous substances, pollutants, or contaminants. These action-specific requirements may specify particular performance levels, actions, or technologies as well as specific levels (or a methodology for setting specific levels) for discharged or residual chemicals.

Construction Occurring Incident to the IRA

Air Emissions

On the remote possibility that there may be air emissions during the course of the construction associated with this IRA, the Army has reviewed all potential ambient or chemical-specific air emission requirements. As a result of this review, the Army found that there are, at present, no National or State ambient

air quality standards currently applicable or relevant and appropriate to any of the volatile or semivolatiles chemicals in the ground water found in the area in which construction is contemplated.

In the context of this IRA, there is only a very remote chance of any release of volatiles or semivolatiles and, even if such a release did occur, it would only be intermittent and of very brief duration (because the activity that produced the release would be stopped and modified appropriately if a significant air emission, based upon specific standards contained in the Health and Safety Plan, was detected by the contractor's air monitoring specialist). Both the Army and Shell have significant experience with the construction of monitoring, extraction and reinjection wells and have not experienced any problems from air emissions during construction of such facilities. Since minimal excavation of saturated material is anticipated, it is not believed that air emissions are likely to occur, as they might if large amounts of saturated material were excavated and necessitated drying. The site-specific Health and Safety Plan will adequately address these concerns. This plan to be developed for use in the IRA will detail operational modifications to be implemented in the event monitoring detects specific levels of such emissions.

The National Emissions Standards for Hazardous Air Pollutants (NESHAPS) were evaluated to determine whether they were applicable or relevant and appropriate to apply in the context of construction of this IRA. These standards were not considered applicable because they apply to stationary sources of these pollutants, not to construction activity. These standards were not considered relevant and appropriate because they were developed for manufacturing processes, which are significantly dissimilar to the short-term construction activity contemplated by this IRA.

The provisions of 40 CFR 50.6, and any more stringent standards found at 5 CCR 1001-14, will be considered relevant and appropriate. These standards are not applicable because they address Air Quality Control Regions, which are areas significantly larger than and different from the area of concern in this IRA. Pursuant to these regulations, there will be no particulate matter transported by air from the site that is in excess of 50 micrograms per cubic meter (annual geometric mean) and the standard of 150 micrograms per cubic meter as a maximum 24-hour concentration will not be exceeded more than once per year.

Worker Protection

The provisions of 29 CFR 1901.120 are applicable to workers at the site because these provisions specifically address hazardous substance response operations under CERCLA. The final rule found at 54 FR 9294 (March 6, 1989) will be operative. (The final rule became effective on March 6, 1990.)

General Construction Activities

The following performance, design, or other action-specific State ARARs have been identified by the Army as relevant and appropriate to this portion of the IRA and more stringent than any applicable or relevant and appropriate federal standard, requirement, criterion, or limitation. These standards are not applicable because they specifically do not address a remedial action or circumstance under CERCLA:

Colorado Air Pollution Control Commission Regulation No. 1, 5 CCR 1001-3, Part III(D)(2)(b), Construction Activities:

- a. Applicability - Attainment and Nonattainment Areas

b. General Requirement

Any owner or operator engaged in clearing or leveling of land or owner or operator of land that has been cleared of greater than one (1) acre in nonattainment areas for which fugitive particulate emissions will be emitted shall be required to use all available and practical methods which are technologically feasible and economically reasonable in order to minimize such emissions, in accordance with the requirements of Section III.D. of this regulation.

c. Applicable Emission Limitation Guideline

Both the 20% opacity and the no off-property transport emission limitation guidelines shall apply to construction activities; except that with respect to sources or activities associated with construction for which there are separate requirements set forth in this regulation, the emission limitation guidelines there specified as applicable to such sources and activities shall be evaluated for compliance with the requirements of Section III.D. of this regulation. (Cross Reference: Subsections e. and f. of Section III.D.2 of this regulation).

d. Control Measures and Operating Procedures

Control Measures or operational procedures to be employed may include but are not necessarily limited to planting vegetation cover, providing synthetic cover, watering, chemical stabilization, furrows, compacting, minimizing disturbed area in the winter, wind breaks, and other methods or techniques.

Colorado Ambient Air Quality Standards, 5 CCR 1001-14, Air Quality Regulation A, Diesel-Powered Vehicle Emission Standards for Visible Pollutants:

- a. No person shall emit or cause to be emitted into the atmosphere from any diesel-powered vehicle any air contaminant, for a period greater than 10 consecutive seconds, which is of such a shade or density as to obscure an observer's vision to a degree in excess of 40% opacity, with the exception of Subpart B below.
- b. No person shall emit or cause to be emitted into the atmosphere from any naturally aspirated diesel-powered vehicle of over 8,500 lbs gross vehicle weight rating operated above 7,000 feet (mean sea level), any air contaminant for a period of 10 consecutive seconds, which is of a shade or density as to obscure an observer's vision to a degree in excess of 50% opacity.
- c. Diesel-powered vehicles exceeding these requirements shall be exempt for a period of 10 minutes, if the emissions are a direct result of a cold engine start-up and provided the vehicle is in a stationary position.
- d. This standard shall apply to motor vehicles intended, designed, and manufactured primarily for use in carrying passengers or cargo on roads, streets, and highways.

The following performance, design, or action-specific State ARAR is applicable to this portion of the IRA and is more stringent than any applicable or relevant and appropriate Federal standard, requirement, criterion or limitation:

Colorado Noise Abatement Statute, C.R.S. Section 25-12-103:

- a. Each activity to which this article is applicable shall be conducted in a manner so that any noise produced is not objectionable due to intermittence, beat frequency, or shrillness. Sound levels of noise radiating from a property line at a distance of twenty-five feet or more there from in excess of the db(A) established for the following time periods and zones shall constitute prima facie evidence that such noise is a public nuisance:

<u>Zone</u>	<u>7:00 a.m. to next 7:00 p.m.</u>	<u>7:00 p.m. to next 7:00 a.m.</u>
Residential	55 db(A)	50 db(A)
Commercial	60 db(A)	55 db(A)
Light Industrial	70 db(A)	65 db(A)
Industrial	80 db(A)	75 db(A)

- b. In the hours between 7:00 a.m. and the next 7:00 p.m., the noise levels permitted in subsection (1) of this section may be increased by ten db(A) for a period of not to exceed fifteen minutes in any one-hour period.
- c. Periodic, impulsive, or shrill noises shall be considered a public nuisance when such noises are at a sound level of five db(A) less than those listed in Subpart (a) of this section.
- d. Construction projects shall be subject to the maximum permissible noise levels specified for industrial zones for the period within which construction is to be completed pursuant to any applicable construction permit issued by proper authority or, if no time

limitation is imposed, for a reasonable period of time for completion of the project.

- e. For the purpose of this article, measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.
- f. In all sound level measurements, consideration shall be given to the effect of the ambient noise level created by the encompassing noise of the environment from all sources at the time and place of such sound level measurements.

In substantive fulfillment of Colorado Air Pollution Control Commission Regulation No. 1, this IRA will employ the specified methods for minimizing emission from fuel burning equipment and construction activities. In substantive fulfillment of Colorado's Diesel-Powered Vehicle Emission Standards, no diesel motor vehicles associated with the construction shall be operated in manner that will produce emissions in excess of those specified in these standards.

The noise levels pertinent for construction activity provided in C.R.S. Section 25-12-103 will be attained in accordance with this applicable Colorado statute.

Wetlands Implications

Through estimation of the general area where any construction would occur or facilities be located and the nature of the facilities to be constructed, the Army does not believe that any wetlands could be adversely affected. However, until a final design is selected, it cannot be definitively determined that no

adverse impact on wetlands will occur. If the final site selection and/or design results in an adverse impact on wetlands, the Army will review the regulatory provisions concerning wetlands impact, generally identified as relevant and appropriate in the discussion of location-specific ARARs above, and other appropriate guidance, and will proceed in a manner consistent with those provisions. Actions taken will be consistent with any requirements of Section 404 of the Clean Water Act. Coordination will be maintained with the U.S. Fish and Wildlife Service concerning any potential impacts on wetlands.

Groundwater Monitoring

The Army has determined that the substantive provisions of the regulations contained in 40 CFR § 264.97, and any provisions of 6 CCR 1007-3, § 264.97 which are more stringent than the federal regulations, are relevant and appropriate to apply to the groundwater monitoring which is to occur pursuant to this IRA. Pursuant to CERCLA Section 121(e), 42 U.S.C. § 9621(e), no federal, state or local permit is required for the groundwater monitoring to be conducted. The specific monitoring program will be developed later in the IRA process and may utilize some number of the existing monitoring wells on the Arsenal, sampling conducted under the Comprehensive Monitoring Program, the addition of new wells and/or sampling requirements or any combination of these approaches in order to fulfill the substantive requirements of these regulations.

Land Disposal Restrictions and Removal of Soil

There are no action-specific ARARs that pertain to the excavation of soil during the construction associated with this IRA.

EPA is currently developing guidance concerning the Land Disposal Restrictions (LDR) and their application during CERCLA response actions. While guidance is limited, the Army has not, at this time, made a determination that any listed waste subject to LDR will be present in the soil removed by this IRA. Further EPA guidance concerning the applicability of LDRs to CERCLA actions is likely to be issued prior to the implementation of this IRA and the Army will review such guidance as it is released. If it is determined that a listed waste is present, the Army will act in a manner consistent with EPA guidance for the management of such within the context of CERCLA actions.

Although removal of soil from the area where any treatment system will be located is a TBC, not an ARAR, it will be performed in accordance with the procedures set forth in the Task No. 32 Technical Plan, Sampling Waste Handling (November 1987), and EPA's July 12, 1985, memorandum regarding "EPA Region VIII Procedure for Handling of Materials from Drilling, Trench Excavation and Decontamination during CERCLA RI/FS Operations at the Rocky Mountain Arsenal." Soils, not included for further treatment, generated by excavation during the course of this IRA, either at surface or subsurface, may be returned to the location from which they originated (i.e., last out, first in). Any materials remaining after completion of backfilling that are suspected of being contaminated (based on field screening techniques) will be properly stored, sampled, analyzed, and ultimately disposed as CERCLA hazardous substances, as appropriate.

For material determined to be hazardous waste resulting from construction activities, substantive RCRA provisions are applicable to their management. These substantive provisions include but are not limited to: 40 CFR Part 262 (Subpart C, Pre-Transport Requirements), 40 CFR part 263 (Transporter Standards),

and 40 CFR Part 264 (Subpart I, Container Storage and Subpart L, Waste Piles). The specific substantive standards applied will be determined by the factual circumstances of the accumulation, storage or disposal techniques actually applied to any such material.

Soil Treatment and Disposal

These proposed remedial actions do not include any significant possibility of on-site or off-site disposal of soils or contaminated material excavated pursuant to this IRA. The selected alternative of monitoring for the South Tank Farm Plume only involves minimal excavation and should result in only small amounts of excavated soil remaining to be handled as discussed above. In the event that some material is later considered for disposal, ARARs for such activities have been generally identified, with more specific analysis to follow after any specific disposal determination is made. On-site disposal of material is not contemplated. For off-site disposal of hazardous material the administrative and substantive provisions of 40 CFR Part 262, Subparts A, B, C, and D, and any provisions of 6 CCR 1007-3, Part 262, Subparts A, B, C, and D which are more stringent than the corresponding federal regulations, are considered relevant and appropriate.

7.5 COMPLIANCE WITH THE OTHER ENVIRONMENTAL LAWS

As is evident from the various portions of this document, this IRA was prepared in substantive compliance with 40 CFR 1502.16 (the regulations implementing the National Environmental Policy Act of 1969).

8.0 SCHEDULE

Consistent with the Federal Facility Agreement and the Final Technical Program Plan FY88-FY92, the milestone for completing the Draft Implementation Document for the South Tank Farm Plume IRA is May 12, 1991. The Deadline for completing the IRA will be established in the Implementation Document.

9.0 CONSISTENCY WITH FINAL RESPONSE ACTION

Although the Final Response Action has not yet been selected, it is believed that this IRA will be consistent with and contribute to the efficient performance of the Final Response Action by:

- (1) monitoring the migration of dissolved contaminants in groundwater emanating from the South Tank Farm site; and
- (2) verifying that the STFP does not impact either Lake Ladora or Lower Derby Lake prior to the Final Response Action. In addition, the natural biodegradation which is occurring is beneficial for any possible response action selected for the plume under the ROD.

10.0 REFERENCES

- Chiang, C. Y., J. P. Salanitro, E. Y. Chai, J. D. Colthart, and C. L. Klein. 1989. Aerobic Biodegradation of Benzene, Toluene, and Xylene in a Sandy Aquifer - Data Analysis and Computer Modeling. Groundwater vol. 27, no. 6, pp. 823-834.
- Ebasco, Services Inc. (Ebasco) 1989a. Final Remedial Investigation, South Plants Study Area Report.
- Shell Oil Company, 1989. Report of Hydrogeologic and Water Quality Investigations in the South Tank Farm Plume, Section 2, RMA.
- Shell Oil Company, May 1990. Hydrogeologic and Water Quality Conditions, South Tank Farm Plume, RMA.
- Shell Oil Company, June 1990. Draft Final Alternatives Assessment, Other Contamination Sources, Interim Response Action, South Tank Farm Plume.
- Shell Oil Company, August 1990a. Final Alternatives Assessment, Other Contamination Sources, Interim Response Action, South Tank Farm Plume.
- Shell Oil Company, August 1990b. Laboratory Screening Studies on the Biodegradation of Organics in RMA Ground Water.
- Shell Oil Company, December 1990a. Technical Work Plan, LNAPL Plume Soil Vapor Extraction Process Field Demonstration Treatability Study.
- Shell Oil Company, December 1990b. Results of the Verification Monitoring Program, South Tank Farm Plume, RMA.
- U.S. Army Waterways Experiment Station, January 1991. Potential Migration of Contaminated Groundwater to Lakes Ladora and Lower Derby.
- Woodward-Clyde, 1989. Final Task Plan for Remediation of Other Sources Interim Response Action.

APPENDIX A

**RESPONSES TO THE USEPA COMMENTS
ON THE STFP IRA PROPOSED DECISION DOCUMENT
LETTER DATED SEPTEMBER 24, 1990**

GENERAL COMMENTS

1. COMMENT:

In Shell's January 4, 1989, IRA proposal, Shell described the South Tank Farm Plume as "a volume of contaminated groundwater located southwest of the central processing area in the South Plants." The Proposed Decision Document is focused solely on the groundwater contamination that is emanating from the light non-aqueous phase liquid (LNAPL) plume located near the South Tank Farm. The Proposed Decision Document and Alternatives Assessment failed to consider and analyze numerous contaminants threatening the lakes and additional plumes other than the LNAPL plume.

The contaminants in the groundwater within the original study area that have sources other than the LNAPL plume have not been addressed. In addition to the five contaminants associated with the LNAPL plume, numerous other contaminants continue to threaten the lakes. The evidence indicates that some of these contaminants may already be adjacent to the lakes at levels that exceed the chronic toxicity levels for aquatic life. In order to be protective of the environment, all of the contaminants in the area south of the South Plants need to be addressed together in a comprehensive IRA approach. The originally-stated scope of this IRA needs to be met to cover all of the contamination that is degrading the environment south of the South Plants and not limit its

focus to only the area outlined by the constituents of the LNAPL plume.

Response:

The above excerpt was taken out of context. The IRA was proposed in a letter dated December 11, 1988, and this proposal clearly identified the "Benzene Plume" as the object of the IRA. Figure 1-1 of the January 4, 1989 document shows the area of concern as the South Tank Farm "Benzene" Plume. Shell's January 4, 1989, Technical Plan was a proposal for field investigations of the STFP and 3 other potential "Hot Spot" sites. The Technical Plan was not an IRA proposal and should not be construed as one.

In the January 4, 1989 Technical Plan, Shell was expressing concern over a potential problem which was not well characterized and required further study. The Technical Plan was not attempting to define a plume, but to describe the location and approximate characteristics of an area which required further investigation. After considerable effort both in the field and office, the STFP (as defined in the IRA documents) and the LNAPL plume were identified as the continuous plume and source of contamination within the South Tank Farm area. These findings are consistent with Shell's original intent of identifying the extent of the "Benzene Plume."

The original documents identified a "Benzene" plume which was of concern. Along the way, the name of this plume was changed to the STFP to reflect the fact that other contaminants are included. The use of this name created confusion because other documents designated another area

and place of origin as the "South Tank Farm Plume." While the name of the plume was changed, the original scope and intent of this IRA have remained as originally stated, in late 1988.

The EPA states:

The evidence indicates that some of these [other than LNAPL] contaminants may already be adjacent to the lakes at levels that exceed the chronic toxicity levels for aquatic life.

It is incorrect for groundwater concentrations to be evaluated using aquatic standards because these are two different media (this point was addressed in the response to Comment 1 by the USDOJ on the Hydrogeologic report, included with the Final Alternatives Assessment for the STFP IRA).

The "other" groundwater contaminants in the South Plants area have been addressed in the Army Waterways Experiment Station (WES) report (Army January 1991). As indicated in the WES report, the lake water quality and biota contamination have been steadily improving over the past years. These trends show that the lakes are not being adversely affected, and in general conditions are improving. The WES report (Army January 1991) concludes that monitoring is the appropriate course of action for the "other" groundwater contaminants. In addition, it should be noted that Shell extended an offer to prepare the report, demonstrating Shell's commitment to understanding the South Plants area.

Shell also completed the verification monitoring program to confirm the observed plume migration rate. These results

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further show that other contaminants are adequately monitored with the proposed programs and there is no significant threat to the lakes.

2. COMMENT:

The Alternatives Assessment did not evaluate the cost-benefit of remediating the groundwater contamination at this time versus cleanup after the final remedy, even for the limited scope upon which Shell has focused this document. Further, neither the Proposed Decision Document nor the Alternatives Assessment considered the benefit of a source control remediation measure for the benzene, toluene, and xylene (BTX) plume. Without comparing the effectiveness and benefits of different alternatives, EPA cannot evaluate the adequacy of the selected alternative.

Response:

Shell's recent investigations indicate that the STFP constituents will not migrate into either lake prior to implementation of the Final Response Action. These findings make it inappropriate to present and evaluate alternative treatment technologies. As stated in Section 22.5 of the FFA, all IRAs shall "to the maximum extent practicable, be consistent with and contribute to the efficient performance of Final Response Actions." Monitoring is the only alternative which contributes to knowledge of the area and which we are assured will meet the FFA criteria. The WES report (January 1991) also concludes that monitoring is the appropriate selection for "other" contaminants. The selection of monitoring as the appropriate course of action for this IRA is in accordance with the process detailed in

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the Final Task Plan for Remediation of Other Sources Interim Response Action (Woodward-Clyde, 1989), and agreed to by the Army, EPA, Shell, and the State.

The natural biodegradation which is occurring is beneficial for any possible response action selected for the plume under the ROD. The Shell Westhollow biodegradation study report (Shell August 1990b) provides preliminary results in support of this natural process.

As stated in the Final Alternatives Assessment, the LNAPL FS Treatability Study should be an adequate source control measure. Shell believes that the LNAPL is best investigated as an FS Treatability Study rather than as part of the IRA because:

- The LNAPL does not present an imminent threat that requires immediate action prior to the final remedy.
- The study will be a research and development effort which will be modified (based on the field performance data collected) such that the effectiveness will be optimized. This type of study will not conform to the IRA requirements for use of "off the shelf" technology and existing data.
- Testing to evaluate treatment technologies is not within the scope of an IRA.
- The treatability testing program will generate field performance data for use at other RMA sites, and to support the FS.

- The time requirements for treatment may exceed the IRA timetable, whereas these time constraints do not apply to Treatability Studies.

3. COMMENT:

Shell has based its alternative selection on the results of a biodegradation study that has not been made available for Agency review. EPA cannot evaluate the conclusions of this study without any knowledge of how it was conducted. Thus, we cannot agree with the proposed remedy for even the narrow scope of the current document.

Response:

It should be noted that the basis for selecting monitoring was the observed actual plume migration rate. The recent sampling of monitoring wells in the South Plants verifies previous findings and supports the basis for selecting monitoring for this IRA. The biodegradation study is a supplemental report which further supports the alternative selection, not the basis for the selection.

The report by Shell's Westhollow research facility (Shell August 1990b) has been provided to the parties. We regret any inconvenience the delay may have caused. Biodegradation studies are time consuming and difficult, for this reason it is very hard to estimate when such a study will be completed.

SPECIFIC COMMENTS

1. COMMENT:

Page 7, Section 2.3. The details of the biodegradation study that was presented by Shell have not yet been made available to the EPA. EPA is being asked to accept the results of these studies on faith and to accept this Decision Document without having the opportunity to review all of the available data pertinent to Shell's biodegradation study. Shell states in their response to EPA's General Comment 2 in the Final Alternatives Assessment for the STFP, "Details of the experimental procedures used in the laboratory biodegradation studies will be presented in a report by Shell's Westhollow Research Center." To date, this report has not been received by EPA.

It is inappropriate for Shell to present a Decision Document without having presented for review all pertinent and relevant data upon which its decision is based especially when the proposed remedy is only to monitor the LNAPL plume.

Response:

See the Response to General Comment 3.

2. COMMENT:

Page 9, paragraph 1. This document limits the analysis of the South Tank Farm Plume (STFP) to those contaminants that are believed to be derived from the LNAPL plume found in the South Tank Farm area which consists of ". . . DCPD and derivatives (58-70%), BCHPD (2.0-2.6%), benzene (0.2-2.1%),

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toluene (0.5-2.0%), and xylene (0.8-1.3%). There are numerous other contaminants also found in the defined South Tank Farm IRA study area, as proposed by Shell. These other compounds constitute an active ground water plume that is migrating toward, and may already be in contact with, the lakes. In one area, these other contaminants lie within the BTX plume boundaries addressed in this document, but in large part these contaminants are detected within the original study area but outside the LNAPL plume boundaries.

These other contaminants that are found in the area (based on 1989 data), along with their maximum concentrations are:

<u>Compound</u>	<u>Value</u> (ug/l)	<u>Well</u>	<u>Chemical Name</u>
11DCLE	71	02506	1,1-Dichloroethane
12DCE	17	02506	1,2-Dichloroethane
13DMB	110	01533	m-Xylene
AS	4.9	02516	Arsenic
ALDRN	0.105	01050	Aldrin
BCHPD	500	01588	Bicycloheptadiene
C6H6	2000000	01539	Benzene
CCL4	29	02513	Carbon Tetrachloride
CHCL3	500	02513	Chloroform
CLC6H5	200	02575	Chlorobenzene
CLDAN	0.876	02001	Chlordane
CPMSO2	5.8	02517	Chlorophenylmethyl sulfone
CYN	16	02020	Cyanide
DBCP	6	01534	Dibromochloropropane
DCPD	700	01588	Dicyclopentadiene
DLDRN	1.72	02001	Dieldrin
ENDRN	1.03	02509	Endrin
ETC6H5	66	01540	Ethylbenzene
HG	0.27	02052	Mercury
ISODRN	0.161	02034	Isodrin
MEC6H5	9000	01552	Toluene
PPDDE	0.224	01588	Dichlorodiphenylethane
TCLEE	24	01534	Tetrachloroethane
TRCLE	5	02575	Trichloroethane
XYLEN	220	01533	Xylene

Many of these compounds currently are, or shortly may be, impacting the lakes, particularly Lake Ladora. The attached maps show the extent of the dieldrin and chloroform contamination.

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A listing of the contaminants that are found in the wells closest to Lake Ladora, based on 1989 data (except where noted) are:

<u>Well</u>	<u>Compound</u>	<u>Value</u> (ug/l)	<u>Chronic</u> <u>Toxicity</u> (ug/l)
02001	CLDAN	0.876	0.0043
	DLDRN	1.72	0.0019
	C6H6	3	-----
	MEC6H5	4	5000
	TCLEE	3	840
	XYLEN	3	-----
02020	CYN	16	5.2
02021	HG	0.16 (1988)	0.012
02022	No detections above CRLs		
02516	CLDAN	0.309	0.0043
	DLDRN	0.639	0.0019
	CHCL3	16	1240
	TRCLE	5	21000
02052	CYN	10 (1988)	5.2
	HG	0.27 (1988)	0.012
02507	11DCLE	24	-----
	12DCLE	6	-----
	CHCL3	170	1240
	TCLEE	6	840
02508	No data available		
02510	No data available		
02512	No data available		
02518	DLDRN	0.101	0.0019
	11DCLE	3	-----
	CHCL3	67	1240
	TRCLE	4	21900
02597	No data available		

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As can be seen in this table, the presence of dieldrin, mercury, chlordane, and cyanide found in several wells very near the lakes is above the chronic toxicity levels for aquatic life. The Biota CMP states that the dieldrin levels in the lake sediments are above the chronic toxicity level for aquatic life. The continued contribution of dieldrin via groundwater will exacerbate the situation.

These compounds must be included in this IRA in order to be protective, since the IRAs are intended to protect the environment from further degradation until the final remedy can be implemented. Since the evidence indicates that these contaminants would at least soon likely impact the lakes, remediation of these contaminants at this time provides a clear benefit to implementation of the final remedy.

Response:

The first table presented in this comment is misleading. As EPA notes, many of the wells are located within the STFP boundaries, and these wells will be monitored according to the program described in the Proposed Decision Document. Additionally, the WES report (January 1991) findings indicate that contaminants which have been detected outside the STFP do not pose a significant threat and that monitoring is the appropriate course of action for these "other" contaminants.

There is no evidence indicating that groundwater contaminants are or will be impacting the lakes prior to implementation of the Final Response Action. The WES report (January 1991) states that surface water sediment transport and historical use of the lakes for process cooling water

may have been the primary pathways for contaminants detected in the lakes. It should also be noted that lake water quality has historically been improving, further showing that other groundwater contaminants are not adversely affecting the lakes.

The attached maps referred to in the comment do not accurately show dieldrin and chloroform "plumes." Use of the data in the May 1990 Hydrogeologic and Water Quality report for the South Tank Farm area will yield a more accurate delineation of the extent of dieldrin and chloroform detections. As mentioned in the WES report, the historic use of the lakes for process cooling water and the ditch and drainage system which feeds the lakes may also have a significant impact on what has been detected.

The second table presents groundwater concentrations and chronic aquatic toxicity levels. This comparison is inappropriate (see Response to General Comment 1).

As far as the lake sediments are concerned, this again is including information which is inappropriate and misleading. Sediment concentrations cannot be compared to aquatic toxicity levels. The sediment investigation carried out in 1983-84 for the Fish and Wildlife Service estimated that deposition in the lakes since the 1970's has stabilized at low concentrations, if not ceased. The sediments containing significant amounts of dieldrin were deposited in the late 1960's. In general, reports conclude that sediments transported through the ditch and drainage systems and the historical use of the lakes for process cooling water have been primary sources of contaminants found in lake sediments, not inflowing groundwater. The methodology

presented in the Biota RI has been critically evaluated and is currently being revised, therefore, use of the criterion established in this report should be carefully utilized for estimating water quality based on sediment concentrations.

3. COMMENT:

Page 11, paragraph 1. The Decision Document must take into account the potential effects of the newly constructed Lower Derby Lake spillway on the groundwater flow pattern and contaminant distribution. Use of the spillway could recharge the unconfined flow system and significantly alter the flow pattern. The potential for this to occur needs to be addressed. Also, resultant alterations in contaminant distribution needs to be evaluated. This could change the selected alternative for this IRA.

Response:

It should be noted that any use of the spillway will be of short duration due to very high precipitation events and not routine practice.

Shell has already taken groundwater elevation and dissolved oxygen (DO) measurements in the area of the new spillway and along the leading edge of the plume. The results from this activity have already been forwarded to the EPA (September 4, 1990).

The proposed monitoring program was designed to include the impact of such occurrences on the hydrogeology. The well network selected for this program will effectively monitor the plume and any effects that the spillway may have on it.

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Results of the verification monitoring program indicate the spillway has not effected the overall hydrogeology or contaminant distribution in the area.

4. COMMENT:

Page 12. Shell has assumed that the limited LNAPL plume that is discussed in the Decision Document will not reach the lakes prior to the final remedy. What criteria will Shell use to reevaluate the effectiveness of the proposed alternative after each sampling event?

Response:

Shell assumes the EPA intends to refer to the STFP, comprised of the LNAPL constituent compounds, as opposed to the separate phase LNAPL plume which is extremely limited in dimension, much farther from the lakes, and has scarcely moved over many years.

After analysis of the data collected each year the extent of contamination, rate of migration, and groundwater flow conditions will be reevaluated. If these conditions change, such that the lakes may be threatened prior to implementation of the final remedy, then action will be taken to mitigate any potential impact on the lakes. The same decision logic (Woodward-Clyde 1989) which has been used to select monitoring, will be reapplied each year when evaluating the current set of data. Specifics of the program will be expanded in the Implementation Document for the STFP IRA.

Specific criteria which may be applied for determining the necessity to consider other alternatives include, but are not limited to, the following:

- The actual measured rate of movement of the leading edge of the plume increases such that it is expected to reach the lakes prior to the Final Response Action.
- Hydrogeologic conditions change such that increased hydraulic gradient indicates the leading edge of the plume will reach the lakes prior to the Final Response Action.
- Changes in dissolved oxygen levels which indicate a major reduction in the current biological degradation.
- Any combination of the above which creates a threatening situation.

5. COMMENT:

Chloroform was listed by Shell as a significant contaminant in its South Tank Farm Plume IRA proposal, dated January 4, 1989; however, Shell failed to consider chloroform in both the Alternatives Assessment and the Proposed Decision Document. Due to these inadequacies, the assessment is incomplete and an alternative cannot be selected.

Response:

The January 4, 1989 document was a Technical Plan proposing field investigations of potential "Hot Spot" sites. This

document was not an IRA proposal and should not be construed as one. See Response to General Comment 1.

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**RESPONSES TO THE COLORADO DEPARTMENT OF HEALTH
COMMENTS ON THE STFP IRA PROPOSED DECISION DOCUMENT
LETTER DATED SEPTEMBER 23, 1990**

GENERAL COMMENTS

1. COMMENT:

The State has repeatedly requested that remediation of the light nonaqueous phase liquid (LNAPL), a source of dissolved benzene, toluene, xylene, bicycloheptadiene (BCHPD) and dicyclopentadiene (DCPD) to the South Tank Farm Plume (STFP), be included in the STFP IRA. Shell, after first identifying the LNAPL as an active source of contamination to groundwater and proposing inclusion of its remediation in the STFP IRA (Report of the Investigation of the LNAPL Plume near Tank 464A, 1 Section 1, RMA, August 1989 [LNAPL Field Report], page 10), has refused to address LNAPL remediation in the context of the IRA. Instead, Shell has proposed to investigate the LNAPL in the context of an FS treatability study. The State agrees with the stated objectives of optimizing LNAPL extraction from the subsurface, but has the following reservations regarding the proposal:

- a. The proposed treatability study was discussed briefly in the Final Alternatives Assessment Other Contamination Sources Interim Response Action South, but was not mentioned in the Proposed Decision Document Other Contamination Sources Interim Response Action South Tank Farm Plume, August 23, 1990 (STFP Proposed Decision Document). Because Shell originally proposed to include the LNAPL investigation as part of the STFP IRA, modification of the scope of this IRA by Shell to

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address the LNAPL in an FS treatability study should be presented in the Final Decision Document. Discussion of the program should include objectives (delineation of the LNAPL plume geometry, identification of sources, optimization of LNAPL recovery), and a proposed time table.

- b. Shell, in its STFP Final Alternatives Assessment Document (p. 10), references "routine monitoring of the areal distribution of mobile LNAPL during 1989 and 1990," and based on these measurements, concludes that the LNAPL is probably "stagnant or migrating at rates below measurement." In response to the State's question regarding these data (STFP Final Alternative Assessment Document, p. A-22, Comment 3), Shell stated that it is currently processing and interpreting recent LNAPL data, which will be included in a forthcoming LNAPL plume Characterization Report. However, these data, never made available to other parties and not discussed in the STFP (Draft, Revised Draft and Final) Alternatives Assessment and Proposed Decision Documents, were the basis for Shell's conclusion that the plume was not increasing in volume or areal extent, and, based on these conclusions, Shell excluded the LNAPL from this IRA. Given Shell's reliance on these data in modifying the scope of the IRA, the data should have been available to all parties. Not only were these data utilized to draw conclusions regarding LNAPL extent in the IRA, but Shell now appear to be using the same data to define the objectives of the LNAPL treatability study. The State strongly objects to Shell's continued practice of gathering data and

relying on those data without including those data in the IRA documents.

Army data relied on in arriving at a proposed remedial selection must be included in the Decision Document, and the parties must be given an opportunity to review and comment on those data and the conclusions drawn therefrom.

- c. At a June 18, 1990 Technical Subcommittee Meeting, Shell technical personnel informed the State, EPA, and the Army that the LNAPL Treatability Work Plan would be available for party review within several weeks of the meeting. However, Shell now states that the "Proposed Work Plan for the LNAPL Treatability Study and Full Scale Test" will not be submitted for party review until after distribution of the STFP IRA Final Implementation Document (STFP Final Alternatives Assessment Document, p. A-16, Response to Comment 5b). If the work plan has been completed for approximately 3 months, why is this delay in distributing it to the parties necessary? If the plan has been completed, please distribute it to the parties now. Otherwise, please explain what modifications to the work plan discussed at the June Technical Meeting have resulted in postponement of distribution of the document.
- d. The State had made various requests regarding the scope of the treatability study, which include:
 - 1) In addition to Tanks 464A and 464B, characterization of other potential sources of contaminants to the LNAPL plume, specifically Tanks 462A, 463A,

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463B, 463E, 463F, 463G (see State Comment 9, p. B27, Final Alternatives Assessment Document);

- 2) Remediation of contaminated soils at and above residual saturation;
- 3) Design of monitoring program to characterize distribution of the LNAPL plume.

Shell appears to agree with these requests, but includes possible qualifications (see Shell Responses to State Comments 2, 7, and 9, pp. B-15, and B-28, respectively, STFP Final Alternatives Assessment Document). The State reiterates its requests that these concerns be addressed.

- e. No time table for completing the LNAPL treatability study has been presented. As the State has previously argued, the LNAPL is actively contributing contaminants to the dissolved STFP, and there is evidence that it is increasing in vertical and horizontal extent. For these reasons, it is desirable to extract and remediate the LNAPLs as quickly as possible. Please provide a timetable outlining a schedule for the FS treatability study. The State again requests that after the completion of treatability study, LNAPL remediation be addressed as an interim action.

Response:

- a. As defined in the FFA, the Proposed Decision Document specifically addresses the course of action for the IRA. Since the LNAPL Treatability Study is not

included in the IRA, it is inappropriate to include this in the Decision Document. The Work Plan for the LNAPL FS Treatability Study presents the study objectives and a proposed schedule for completion.

- b. The Report of the Investigation of the LNAPL Plume Near Tank 464A, Section 1, RMA was made available to the parties in August 1989. The most recent data (March and November 1990) are included with the attached table. The data indicates the plume has not migrated, and the apparent LNAPL thickness is affected by the changing hydrologic conditions in the South Tank Farm area. The decline in the water table elevation allowed LNAPL, which used to be entrapped beneath the water table, to become mobile and as a result the apparent hydrocarbon thickness increased (Kemblowski and Chiang, "Hydrocarbon Thickness Fluctuations in Monitoring Wells," Ground Water, Vol. 28, No. 2, pp. 244-252).
- c. The LNAPL FS Treatability Study Work Plan has been provided to the parties.
- d.
 - 1) As stated in the response to the referenced comment, the areal extent of the LNAPL plume in the vicinity of Tank 464A will be investigated as part of the FS treatability study. This is detailed in the work plan.
 - 2) The treatability study will evaluate the effectiveness of Soil Vapor Extraction (SVE) for the treatment of contaminated soils. In order to perform this analysis, contaminated soils (at and

above residual saturation of contaminants) will be examined.

- 3) The characterization of the LNAPL plume is a component of the treatability study. Existing and new wells will be measured and sampled, and soil samples will be collected and analyzed. The specifics of this program are addressed in the treatability study work plan.

- a. The treatability study work plan provides the schedule for work proposed under the study. The treatability study will be a source control measure for the LNAPL in which one portion of the program is the extraction of LNAPL. To further aid in the development of proposed investigations, Shell requests the State provide the data which it believes is evidence of an increase in the vertical extent of the LNAPL, after review of the reference cited in response b. above.

2. COMMENT:

The traditional approach in the industry in an LNAPL remediation program includes removal of the mobile free product prior to initiating enhanced LNAPL recovery. Is Shell considering applying enhanced recovery techniques prior to removal of the mobile product? If not, then LNAPL recovery using traditional, off-the-shelf technologies should be included as part of the STFP IRA; the enhanced recovery LNAPL treatability studies could then be conducted in the context of the proposed FS program, and the LNAPLs could be remediated as a future interim action.

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Response:

The proposed treatability study is intended to investigate the applicability and effectiveness of a remediation technology for the potential cleanup of STF LNAPL contaminated soils and other similar sites on the RMA. The purpose of the treatability study is to learn more about processes and to gather data for evaluating these processes. The proposed treatability study will include free product recovery from existing wells. This process will be performed along with SVE operation to assess the applicability of these techniques to the site. The treatability work plan details these efforts further. Several vendors have replaced the traditional approach, noted by the State, with an integrated approach.

3. **COMMENT:**

After referencing bioremediation studies in prior STFP deliverable documents without presenting location of the samples or objectives and limitations of the program, Shell has finally indicated that their Westhollow Research Center will be presenting details regarding the laboratory experimental procedures in a third quarter 1990 report. Please distribute this product to all parties since data interpretation regarding benzene biodegradation in Sections 1 and 2 has already been included by Shell in STFP documents.

Response:

See Response to EPA General Comment 3.

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SPECIFIC COMMENTS

1. COMMENT:

Page 7. Shell states,

High concentrations [of STF dissolved phase plume in groundwater] also occur near Tanks 463A, 463E, and 463G, and Tanks 624A, 463B, and 463F may be potential sources of contaminants common to the defined STFP constituents.

The State agrees with, and has indicated in previous STFP comment packages, that these tanks are possible sources of contaminants to groundwater. Shell, at the State's request, has agreed to investigate these areas as part of the LNAPL treatability study. Because the tank investigation was not discussed in the Proposed Decision document text, the State requests a meeting with Shell regarding the status of the treatability study and the LNAPL source investigation.

Response:

Under the FS treatability study in the South Tank Farm, Shell will conduct an investigation for further defining the extent of residual LNAPL in the unsaturated soils and as a free phase liquid at the groundwater surface in the vicinity of Tank 464A.

The FFA specifies that the Proposed Decision Document be a precise document addressing the IRA. Since the LNAPL treatability study is to be performed under the FS at the RMA, it is inappropriate to include mention of the treatability study in this IRA document and was accordingly

omitted. The meeting held on October 12, 1990 discussed the FS treatability study, including the LNAPL investigation, and the Technical Work Plan for the treatability study has been provided to the parties.

2. COMMENT:

Page 8. Shell states,

[t]he results of the 1990 investigation indicated that . . . cross-[cont]amination probably occurred during the Spring 1988 sampling event resulting in the overestimation of the extent and rate of dissolved benzene migration

Contrary to what Shell has stated, Spring 1988 data were not used to calculate extent and rate of dissolved benzene migration, but were instead used to qualitatively indicate that potential serious groundwater contamination existed in Sections 1 and 2; based on these data, additional investigations were undertaken.

Nowhere in any previous document does it state that 1988 data were used to determine extent and rate of benzene migration; on the contrary, the Report of Hydrogeologic and Water Quality Investigations in the South Tank Farm Plume Section 2, RMA, July 1989 indicates that the Winter 1989 sampling event was conducted specifically to increase understanding of contaminant distribution east of Lake Ladora in Sections 1 and 2 by supplementing an incomplete database.

Shell continues to reference 1988 data incorrectly; please modify the text in the Final Decision Document to indicate

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that 1988 data were only used qualitatively to indicate that additional investigations regarding Sections 1 and 2 groundwater contamination were necessary.

Response:

In the December 19, 1988 letter, proposing the "Benzene Plume" be added to the list of IRA sites, Shell cites the 1988 data in expressing concern over the rate of migration and the extent of contamination. This previous document explicitly states that 1988 data were used for evaluating the rate of migration of the benzene plume as compared to the 1983 results. Subsequently, after further investigations the 1988 data were determined to be suspect. The 1988 data was used quantitatively for assessing the more accurate updated data, which is the basis for this IRA selection. Accordingly, the text of the Proposed Decision Document does not require modification.

3. **COMMENT:**

Page 10. Shell states,

There is no significant long-term benefit
(either cost or accelerated cleanup) of
conducting an interim response action on the
. . . LNAPL plumes since migration is very
slow

This conclusion is unsupported by an cost analysis contained in either the Proposed Decision Document or the Alternative Assessment. The State is in disagreement with the possible downgradient extent of the LNAPL plume identified by the Shell LNAPL Field Report. Determining the downgradient

extent is necessary since this directly correlates to the volume of soils contaminated with LNAPL, and indicates cleanup costs. Since cleanup costs will depend upon the extent of the LNAPL contamination accurate characterization is necessary before a reliable costs analysis can be performed. Such a cost analysis is required before a final decision can be made.

Response:

See Response to USEPA General Comment 2.

4. **COMMENT:**

Page 11. Shell states that the proposed STFP IRA target analytes will be limited to benzene, toluene, xylene, BCPD, and DCPD. The State again requests that, to adequately monitor the impact of contaminants on the south lakes, the program should be modified to include all RMA target analytes. It is unclear if the Army's follow-up to its review of existing data pertaining to "other contaminants" include periodic monitoring of all necessary RMA analytes. For this reason, the State again stresses the importance of a more inclusive monitoring program.

Response:

The monitoring program established to comply with this IRA will specifically target the LNAPL constituent compounds. The groundwater samples will be analyzed using Method UU8 for volatile compounds. This analytical method inherently provides data for other volatile compounds, including chloroform and chlorobenzene. The Army's review of the

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existing data pertaining to "other contaminants" concludes that the IRA monitoring program is an appropriate course of action.

5. COMMENT:

Page 11. To monitor contaminant migration immediately upgradient of the western end of Lower Derby Lake, the State requested that Well 01075 be incorporated in the one-time comprehensive and routine annual STFP monitoring programs (see State General Comment 5a, p. A-16, STFP Final Alternatives Assessment Document). In response, Shell stated that construction activities relating to the Lower Derby Lake spillway and embankment modifications may have resulted in damage to the well. The State requests that, if damaged, Well 01075 be replaced and the replacement well be incorporated in the STFP monitoring programs. Well 01075 will provide more information regarding possible impact on Lower Derby Lake from upgradient contaminants.

Additionally, please inform all parties as soon as spillway and embankment modifications are completed as to which wells were damaged by the construction and which have been selected for replacement, and describe the location and completion details of all new wells added as part of the modification program.

Response:

The spillway and embankment modifications are essentially complete. Four Shell wells which were damaged during construction of the spillway have been abandoned. These Wells are 01560, 01587, 02561, and 02584. All 4 wells will

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be replaced once the STFP IRA Decision Documents are finalized.

Incorporation of Well 01075 (or its replacement) in the proposed IRA monitoring network has been noted in the text.

6. COMMENT:

Page 12. Please include monitoring wells upgradient from the leading edge of the STFP in Section 2 and along the axis of the plume in the annual monitoring program. This will provide temporal data regarding upgradient concentration which could alter interpretation of plume migration rates.

Response:

The following wells, which are included in the annual monitoring network, are located upgradient and along the axis of the STFP:

<u>Well Number</u>	<u>Approximate Distance Upgradient (ft)</u>
02504	50
02503	250
02502	450
02501	600
02576	700
02584*	1100

*or its replacement well

These wells should provide temporal data for properly interpreting future plume migration rates. Results of the Verification Monitoring Program indicate the plume has not

advanced since Spring 1990, and that natural biodegradation is limiting the extent of the plume along the leading edge.

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